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Internalized Socioemotional Functioning of Children and Adolescents with Nonverbal Learning Disability and Asperger's Syndrome

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by

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Dedication

This dissertation is dedicated to my husband and son, Todd and Luke Morris. Thank you for all the love, support, and patience that helped me complete this project.

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Abstract: Visual-spatial skills deficits are one of the primary neuropsychological deficits among children with Nonverbal Learning Disability (NVLD; Rourke, 1989) and Asperger's Syndrome (AS; Ellis, & Gunter, 1999; Klin, Volkmar, Sparrow, Cicchetti, & Rourke, 1995). In addition to affecting written tasks, visual-spatial deficits also have implications for the social functioning of children. Children who are not able to accurately process visual-spatial information will have difficulty processing the visual, nonverbal cues present in social situations including facial expressions, hand movements, and body posture (Nowicki & Duke, 1992). These social perception deficits make social interactions difficult for these children. As a result of their social differences, they are likely to get negative reactions from others, have social skills deficits (Petti, Voelker, Shore, and Hayman-Abello, 2003), and have much difficulty fitting in with same-aged peers. These social skills deficits will likely lead to internalized adjustment problems in

which these children feel isolated, withdrawn, and depressed around their peers. This sequence of events, visual-spatial deficits, followed by social perception deficits, followed by social skills deficits, which ultimately lead to internalized emotional problems, is implied, but not empirically proven, in a study by Petti and colleagues (2003). In addition to experiencing greater socioemotional problems than other LD subtypes, visual-spatial and social deficits of children with NVLD have been shown to worsen with age (Casey, Rourke and Picard, 1991).

This dissertation study investigated the relation between these four constructs (i.e., visual-spatial skills, social perception, social skills, and internalized emotional functioning). It was hypothesized that social perception and social skills mediate the relationship between visual-spatial skills and internalized emotional functioning. In addition, these deficits were expected to increase as these children get older. As NVLD and AS are commonly co-morbid with Attention Deficit/Hyperactivity Disorder-Predominantly Inattentive Type (ADHD: PI; Gross-Tsur & Shalev, 1995; Voeller, 1996), this diagnostic group was compared to children diagnosed with ADHD: PI. An additional aim of this study was to differentiate the classification of Learning Disability (LD) by demonstrating the socioemotional functioning differences between individuals with NVLD/ADHD: PI and their counterparts -- individuals with a Verbal Learning Disability (VLD/ADHD: PI).

Seventy-one children, ranging in age from 8-14 participated in the study and were assigned to one of three groups (e.g., NVLD/AS with ADHD: PI, VLD with ADHD: PI, or ADHD: PI) based on pre-determined criteria. The NVLD/AS group, as expected,

showed impairments in all areas (i.e., visual-spatial skills, social perception, social skills, and internalized socioemotional functioning) and significantly differed from one or both of the other groups on each of the four domains. Support was not found for the age effects for the NVLD/AS group. That is, visual-spatial and internalized socioemotional scores did not worsen with increasing age as expected. Also, visual-spatial skills were not significantly related to internalizing socioemotional functioning, and the hypothesized mediation variables were not statistically significant.

The current study contributes to the understanding of individuals with NVLD, an under-studied population. The proposed visual-spatial skills deficits and social perception deficits in Rourke's (1989) theoretical model were supported. This study also offers some insight into the internalizing socioemotional functioning of children with NVLD. It clarifies the heterogeneity of socioemotional functioning among LD children, suggesting that it is children with the LD subtype, namely NVLD, who are at greater risk for social problems.

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CHAPTER I: INTRODUCTION

When viewed collectively, children with learning disabilities (LD) often experience social problems. As various LD subtypes are recognized, it is becoming clear that some children with LD experience different academic problems in addition to varying degrees of social problems. It has been hypothesized that children with one LD subtype, that is, Nonverbal Learning Disability (NVLD), are at greater risk for social and emotional problems due to the specific pattern of neuropsychological assets and deficits that are a part of this disorder (Rourke, 1989). Visual perception deficits are one of the primary neuropsychological deficits among children with NVLD (Rourke, 1989) that are thought to manifest as social problems and ultimately psychopathology (Petti, Voelker, Shore, & Hayman-Abello, 2003). Children with Asperger's Syndrome (AS) exhibit similar characteristics, including visual spatial deficits and social competency problems. Some researchers suggest that AS, NVLD, and high functioning autism (HFA) are all part of the autism spectrum disorder that represent different manifestations and symptom combinations of the same underlying source of dysfunction (Denckla, 1983; Gillberg, 1992, Vacca 2001).

In addition to affecting written tasks, visual perception deficits have implications for the social functioning of children. Children who are not able to accurately process visual-spatial information will have difficulty processing the visual, nonverbal cues present in social situations including facial expressions, hand movements, and body posture (Nowicki & Duke, 1992). These social perception deficits make social interactions difficult for these children. As a result of their social differences, they are likely to have social skills deficits and receive negative peer reactions (Petti et al., 2003).

These social skills deficits could potentially lead to internalized adjustment problems in which these children feel isolated, withdrawn, and depressed around their peers. It has been suggested and empirically shown that children with NVLD are at greater risk for experiencing higher levels of internalizing problems than other Learning Disability subtypes (DeLuca, Rourke, & Del Dotto, 1991; Ozols & Rourke, 1985; Pelletier, Ahmad, & Rourke, 2001; Strang & Rourke, 1985). Furthermore, this population may be at greater risk for suicide than other LD subtypes (Rourke, Young, & Leenaars, 1989). These alarming postulations warrant a significant amount of attention as it is the responsibility of individuals in the field of education to attend to the academic as well as social development of students.

Petti and colleagues (2003) propose that there is a relation between the four constructs under investigation in this study (i.e., visual-spatial skills, social perception, social skills, and internalized socioemotional functioning). More specifically, they suggest that social perception problems are manifestations of visual-spatial deficits that are present in young children with NVLD and other social competency disorders (e.g. Asperger's Syndrome). These social perception deficits, they suggest, lead to social skill deficits and psychopathology. To test the validity of this proposed relation, it is hypothesized in the current study that social perception and social skills mediate the relation between visual-spatial skills and internalized socioemotional functioning. This study will also attempt to demonstrate that children with NVLD or AS experience more socioemotional problems than another LD subtype (i.e., Verbal Learning Disability; VLD) and such impairments will worsen with age. As NVLD and AS are commonly co-morbid with ADHD: Predominantly Inattentive Type (ADHD: PI; Ghaziudding, Weidmer-Mikhail, and Gaziuddin, 1998; Gross-Tsur & Shalev, 1995; Voeller, 1986), the participants will be limited to children with NVLD or AS who also meet criteria for

ADHD: PI. Additionally, the VLD counterparts will also meet diagnostic criteria for ADHD: PI. To control for the confounding effects that attention has on the social functioning of these children, an ADHD: PI diagnostic group will be included so that the presence of social deficits will manifest above and beyond the attention deficits.

A large body of research in this area exists; however, much of it is equivocal due to methodological flaws, inconsistent diagnostic criteria, and small sample sizes. Moreover, the research results from past studies are largely based on the clinic-referred population of Rourke and his colleagues which limits generalizability to the rest of the population. Very little research has been done on school-referred samples. The current research study will use a school-referred population and a methodologically sound design in an effort to explain the social deficits that differentiate NVLD children from their VLD and ADHD: PI counterparts.

Although there has been empirical support for the presence of NVLD among LD children, this diagnostic label has yet to be included in the Diagnostic and Statistical Manual of Mental Disorders – Fourth Edition (American Psychiatric Association, 2000). This is mostly due to the fact that experts have yet to agree upon the diagnostic criteria. Thus, it is evident that there is more to be learned about this LD subtype so that educators, psychologists, and researchers can properly understand, diagnose, and treat the disorder. Results from the current study will contribute to the understanding of NVLD, an under-diagnosed Learning Disability subtype, and will pave the way for improved academic and social interventions.

This study will address the following research questions:

1. Are there differences among diagnostic groups (i.e., NVLD/AS, VLD, and, ADHD: PI) on measures of visual-spatial skills, social perception, social skills, and internalizing socioemotional functioning?

2. Does the effect of diagnostic group on visual-spatial scores depend on age?
3. Does the effect of diagnostic group on internalizing socioemotional functioning depend on age?
4. Do social perception and social skills serve as mediating variables in the relation between visual-spatial skills and internalizing socioemotional problems in children?

CHAPTER II: LITERATURE REVIEW

Learning Disabilities

Traditionally, children have been diagnosed with a learning disability when they demonstrate a significant discrepancy between their ability and academic achievement in the absence of sensory impairment, mental retardation, emotional handicaps, or environmental disadvantage. An assessment of such a discrepancy typically utilizes an intelligence test and standardized achievement test. Although other methods of identifying learning disability have been employed, the current study will operate under the cognitive-achievement discrepancy model of LD identification.

Whereas children and adolescents with LD were once treated as a homogeneous group, it is becoming clear that these children possess different patterns of cognitive abilities, academic achievement, and socioemotional functioning (Fuerst & Rourke, 1991, 1993; Porter & Rourke, 1985; Strang & Rourke, 1985). Thus, forming conclusions on the basis of a homogeneous LD population instead of a differentiated LD population may eliminate important trends that are relevant to only certain LD subtypes. Because such differences are now known to exist, it is salient that researchers differentiate LD participants on the basis of one or more of these domains.

Researchers have attempted to investigate patterns of functioning in a specific LD subtype – nonverbal learning disability (NVLD), a term originally coined by Myklebust (1975). In accordance with recommendations of previous researchers, the focus of this paper will address the socioemotional differences between differentiated groups of children with two LD subtypes – NVLD and verbal learning disability (VLD). Whereas verbal learning disabilities involve deficits in language skills (e.g., written language, oral

expression, reading), nonverbal learning disabilities involve deficits in nonverbal skills (e.g., problem solving, novel reasoning, nonverbal communication). The next section describes the construct of nonverbal learning disabilities as it relates to cognitive, academic and neurobiological aspects of an individual.

Nonverbal Learning Disabilities

NONVERBAL COMMUNICATION

In general, successful communication with others includes verbal and nonverbal components. In fact, 65% of the communication in an average conversation is believed to be nonverbal (Rothenberg, 1998). In addition to spoken words, a person uses nonverbal communication including facial expressions, posture, gaze, gestures, and vocal quality, also known as prosody (Brumback, Harper, Warren & Weinberg, 1996). Most individuals take these nonverbal aspects for granted because they are generally acquired and used naturally. They are skills that infants begin learning immediately after birth as they engage mostly in visual-spatial and emotional stimulation. For individuals who have deficits processing such nonverbal information, communication and daily functioning can become difficult and overwhelming.

DEFINITION OF NVLD

The learning disability subtype that results from such nonverbal deficiencies is known as nonverbal learning disability. It is estimated that approximately 5% to 10% of students with learning disabilities, or less than 1% overall, exhibit the pattern of NVLD (DeLuca et al., 1991; Rourke, 1989). Myklebust (1975) claims that it is more debilitating than verbal learning disabilities because their social perception (i.e., the ability to understand the social environment) deficiency "impedes the development and acquisition of meaning" (p. 87). Due to their distortions of daily experiences, these children present

as immature and as having difficulty in routine judgments needed for daily living. They have difficulty judging the actions and intentions of others. Other nonverbal learning difficulties that they possess include concepts related to time, directions, size, distance, spatial orientation, and right from left.

In his model, Rourke (1989) conceptualizes this disability as a neurodevelopmental disorder that is present at birth. Rourke proposes that NVLD is a manifestation of white matter (long myelinated fibers) in the brain that is underdeveloped, damaged or dysfunctional (Rourke 1995; Tsatsanis & Rourke 1995). A series of primary, secondary, and tertiary assets and deficits are causally related in that one sequentially leads to the next. The combination of assets and deficits affect formal learning (e.g., math, reading), informal learning (e.g., play and other social situations) and psychosocial functioning (e.g., relationships with others). Appendix A presents this conceptualization in greater detail.

Individuals with NVLD maintain assets in rote material (e.g., memory, language) allowing them to succeed as readers and spellers in school. Also, they tend to have a good verbatim memory of oral material as their auditory perception is superior to their visual perception. Primary deficits include tactile perception, visual perception, complex psychomotor skills and novel reasoning. Also prevalent are difficulties with problem solving, hypothesis testing, and concept formation. Although their basic language skills are intact, they are deficient in pragmatics and have superficial semantic knowledge (Volden, 2002). They communicate with little or no speech prosody, much verbosity, and use colorless, repetitive language. This social communication style is likely to negatively affect other children's responsiveness to them. With little interest from others, it is expected then, that their socioemotional functioning will be affected. Their over-reliance on and desire for rote material makes adapting to new situations very difficult. They are

also deficient in exploratory behavior--a result of their desire for rote material, avoidance of novelty, problems with complex psychomotor skills, and a preference for auditory information processing over visual information processing. Thus, they prefer to learn about their environment through hearing about it instead of seeing or touching it. In school, they are likely to have difficulty with reading comprehension (due to problems in inferential reasoning), handwriting (due to weak graphomotor skills), mechanical arithmetic (due to deficits in visual-spatial-organization, psychomotor skills, dealing with novelty, concept formation, and hypothesis testing), and science (due to deficits in problem solving, concept-formation, and novel reasoning).

According to Rourke's model (1989), age-related changes in neuropsychological, intellectual, and academic functioning will occur such that children with NVLD will become progressively more impaired on tasks that require intermodal integration, problem-solving, visual-perceptual, and concept formation abilities. This deterioration in skills is due to their "impoverished ability to generate new descriptive systems" (Casey, Rourke, & Picard, 1991, p. 333). Although they are expected to decline in some areas, it is also expected that the skills that are relative strengths for them (i.e., rote verbal skills, spelling, simple motor and tactile-perceptual skills) will remain stable as they mature.

There is research that provides sound empirical support for Rourke's model (Harnadek & Rourke, 1994) and other research that provides only partial support for this model (Casey et al., 1991; Davis & Par, 1997). Results of one study indicate that the primary deficits in Rourke's model are indeed the major neuropsychological features that characterize and distinguish children with NVLD from children with verbal deficits and nonclinical groups (Harnadek and Rourke, 1994). In another study, a cross-sectional design produced significant results in support of Rourke's developmental progression of the disorder (Casey et al., 1991). These researchers demonstrated that younger children

with NVLD significantly outperformed older children with NVLD on tasks of visual-perception, complex tactile, complex motor, problem-solving, and arithmetic. The younger children with NVLD performed approximately 1 standard deviation below the normative population whereas the older children performed approximately 1 _ to 3 standard deviations below the mean. Thus, it is evident from this study that neuropsychological and academic deficits are present within this population of students. However, contradictory results were revealed in the longitudinal analysis of this same study. Instead of demonstrating deteriorating performance on tasks measuring their deficits, these individuals demonstrated stable performance on such tasks as they aged. This lack of support in this longitudinal design could possibly be due to methodological flaws, selection bias, and an introduction of treatment following the first assessment (Casey et al., 1991). Thus, Rourke's proposal of the developmental progression of this disability is not resolved. It is important to investigate the effects of increasing age on this particular disorder as it has implications for the type of intervention and time of implementation.

ASSESSMENT OF NVLD

Within the fields of education and psychology, there is a lack of consensus on the diagnostic criteria for NVLD. Educators have limited knowledge about the disorder because the literature concerning the disorder is mostly found in medical and psychological publications instead of sources that are readily accessible. Because it does not receive the same attention from educators as verbal disabilities, educators are less likely to make referrals for such an evaluation. The work of Rourke and his colleagues and others have attempted to raise awareness for this disability so that children get the necessary interventions for academic and social progress. Myklebust (1975) suggests an extensive psychological evaluation in order to identify children with nonverbal deficits.

Such an evaluation should include comprehensive language assessment (spoken, reading, written), nonverbal cognitive abilities, spatial orientation, judgment of size, speed, height, and laterality, perception of body parts, social maturity, and motor functions. In addition to a standardized intelligence and personality/behavioral data, Rourke (1989) suggests a broad neuropsychological evaluation that includes tasks of varying complexity measuring sensory, perceptual, motor/psychomotor, attentional, linguistic, concept-formation, problem-solving, and hypothesis-testing skills.

DIAGNOSTIC CRITERIA. In the majority of the literature, NVLD diagnoses were made when a child with suspected neurological problems was referred for additional testing. After a battery of neuropsychological tests, clinical judgment was used to determine if the child's profile matched conceptualizations of this disorder. This process was used by Rourke and his colleagues in various investigations (Casey et al., 1991; Fuerst & Rourke, 1993; Harnadek & Rourke, 1994). In their research studies, five criterion were established for initial screening:

1. tactile perceptual deficits, as measured by Reitan-Klove Sensory-Perceptual Exam
2. fine motor deficits as measured by Grooved Pegboard Test
3. difficulties organizing visuospatial information as measured by the Target Test or a composite of the Target Test and Trail Making Test, Part-B
4. good verbal capacities as measured by Wechsler Intelligence Scale for Children, Verbal Intelligence Quotient
5. basic arithmetic deficiencies as measured by Wide Range Achievement Test, Arithmetic subtest.

Individuals who met the initial criteria had their testing protocols and reports examined by researchers to determine if they exhibited neuropsychological and academic features consistent with the NVLD syndrome.

FUNCTION OF THE RIGHT HEMISPHERE

Neurobiological causes of NVLD are thought to originate in the right hemisphere of the brain (Rourke, 1989). Extensive research has been conducted to delineate the functions of specific parts of the brain. Social interaction functions that appear to be best performed by the right cerebral hemisphere are object and facial recognition, prosody and primary emotionality, empathy and comprehension of emotionality, wit and humor, primary visual imagery, and primary auditory imagery (Brumback & Weinberg, 1990; Heilman & Valenstein, 1993; Molfese & Segalowitz, 1988; Weinberg, Harper & Brumback, 1995a; Weinberg, Harper, & Brumback, 1995b). Empirical evidence supports the role of the right hemisphere in nonverbal communication and social-emotional information. In one study, patients with right hemisphere damage had significantly more difficulty judging the emotional content of sentences depicting facial, prosodic, and gestural expressions (Blonder, Bowers & Heilman, 1991). Brumback (1985) hypothesized that the WISC's Performance Intelligence Quotient (PIQ) reflects right-hemisphere processes whereas the Verbal Intelligence Quotient (VIQ) reflects left-hemisphere processes. Semrud-Clikeman and Hynd (1990) suggested that "nonverbal social-emotional problems and arithmetic difficulties may be related to right hemisphere dysfunction, as both involve the manipulation of spatial and visuoperceptual processes" (p. 200). This postulation is supported by empirical data that demonstrates a positive correlation between social skills and arithmetic skills (Badian, 1983; Kirby & Asman, 1984). That is, children poor in mathematical computation but at least average in reading comprehension have more problems than non-disabled peers in social adjustment and acquiring social skills.

Other researchers have cited the role of the right hemisphere in depression (Kinsbourne & Bemporad, 1984; Lenti, Giacobbe, & Pegna, 2000; Weintraub &

Mesulam, 1983; Wexler, 1980). The right hemisphere has been implicated as a key brain structure in emotion/cognition interactions (Liotti & Mayberg, 2001). Damage to this region is associated with reduced emotionality which may be concomitant to depression (Kinsbourne & Bemporad, 1984). It has also been shown that depressed mood impairs right hemisphere function by interfering with arousal mechanisms (Liotti & Tucker, 1992). Manoach, Sandson, and Weintraub (1995) have implicated right-hemisphere dysfunction in patients with social-emotional processing disorder characterized by poor nonverbal intellectual ability, poor paralinguistic communication skills, and impaired interpersonal adaptability. Additional features include attention problems, math deficits, and depression.

RIGHT-HEMISPHERE DEFICIT SYNDROME

Right-hemisphere Deficit Syndrome (Voeller, 1986, 1995), and Developmental Right-hemisphere Syndrome (Gross-Tsur & Shalev, 1995) are terms assigned to individuals bearing deficits in this region of the brain. Clinical investigations of children with right hemisphere dysfunction exhibited similar clinical features as children with NVLD. The consistent profile across four studies included a higher Verbal IQ than Performance IQ, higher reading than math achievement, socioemotional problems (e.g., withdrawal, isolation, and depression), atypical prosody, difficulties in abstract thinking and concept formation, and graphomotor dysfunction (Gross-Tsur & Shalev, 1995; Semrud-Clikeman & Hynd, 1990; Tranel, Hall, Olson, & Tranel, 1987; Weintraub & Mesulam, 1983; Voeller, 1996). Voeller concluded that this disorder "has a profound impact on a child's capacity to develop the ability to behave in an affectively appropriate fashion and to perceive the emotional states of other human beings" (1996, p. 1008).

Researchers have assimilated NVLD and right-hemisphere syndrome and have proposed that the two are very similar, if not the same (Gross-Tsur, 1995; Semrud-

Clikeman & Hynd, 1990). Thus, for the remainder of this paper, the terms NVLD and Right-hemisphere Deficit Syndrome will be used interchangeably.

COMORBIDITY BETWEEN NVLD AND ADHD

Researchers have found that many children with right-hemisphere deficit syndrome also meet clinical criteria for ADHD (Gross-Tsur & Shalev, 1995; Voeller, 1996) possibly due to attentional disorders being associated with that particular region of the brain (Brumback & Staton, 1982). Voeller (1996) states that these children exhibit the Predominately Inattentive subtype of ADHD. Such children, however, differ from those who have ADHD without signs of right-hemisphere dysfunction. Landau and colleagues (1999) suggest that there are different neurological origins for attention problems in children with right-hemisphere deficit children and children with ADHD. In their study the right-hemisphere deficit group, who also had comorbid ADHD, were inefficient and slower throughout the duration of an attention task whereas the ADHD group were progressively more efficient on this task. Also, there was a difference in group performance that is consistent with conceptualizations of the respective disorders -- the right-hemisphere deficit group performed better on an attention task involving rote, ritualistic stimuli, whereas the ADHD group performed better on attention tasks involving novel stimuli.

Asperger's Syndrome

DEFINITION

Asperger's Syndrome (AS) was named after the Austrian physician who described the condition among a number of his clinical cases (Asperger, 1944). In the DSM-IV (APA, 2000) it is listed as one of five pervasive developmental disorder (PDD) subtypes. It is also falls under the autism spectrum disorder classification and is

characterized by social impairment and restricted and repetitive behavior and interests. Unlike in autism where language deficits are present and cognitive development is delayed, individuals with Asperger's Syndrome have no clinically significant deficits in these areas. Social interaction problems include verbosity, one-sided communication, and impaired prosody. Children with AS also have difficulty reading nonverbal cues.

COMPARISON BETWEEN ASPERGER'S SYNDROME AND HIGH FUNCTIONING AUTISM

Researchers continue to debate the validity of AS as a separate disorder from other PDD subtypes. High functioning autism (HFA), for example, is most often compared to AS. Some maintain that AS and high-functioning autism are the same disorder (Wing, 1998). HFA includes all of the features of autism with the exception of delayed cognitive development. Similarities between HFA and AS include impaired social interaction and restricted repetitive behavior and interests. The difference between the two subtypes, however, is that individuals with AS are more aware of and bothered by the isolative effects of their social impairments (Bonnet & Gao, 1996; Nordin & Gillberg, 1998). Also, from a neuropsychological perspective, distinctions between the profiles of HFA and AS have been documented in previous research. Children with HFA typically have intact visual-spatial skills and consistently better nonverbal than verbal performance on intelligence tests. Left cerebral hemisphere deficits have been suggested as a neurobiological basis of the HFA (Klin, Volkmar, Sparrow, Cicchyetti, & Rourke, 1995). For children with AS, visual-spatial deficits and the opposite cognitive pattern of performance (i.e., VIQ>PIQ) are more common features (Ellis & Gunter, 1999; Klin, Volkmar, Sparrow, Cicchetti, & Rourke, 1995). Evidence suggests that for individuals with AS, there may be damage to or dysfunction of white matter tracts in the right hemisphere (Gunter, Ghaziuddin, and Ellis, 2002).

CONVERGENCE BETWEEN ASPERGER'S SYNDROME AND NVLD

The strikingly similar pattern of nonverbal deficits exhibited by children with AS and NVLD has prompted several researchers to investigate the neuropsychological convergence between the two disorders. Indeed, researchers have found similarities that make the disorders look practically indistinguishable. In general, the disorders are described by intact verbal processing in the presence of visual-spatial and nonverbal deficits (Gunter, Ghaziuddin, and Ellis, 2002; Rourke, Ahmad, Collins, Hayman-Abello, et al., 2002). Also, the inability to judge social situations is another common feature between the two disorders (Ellis, Ellis, Fraser, and Deb, 1994). Ghaziuddin and Mountain-Kimchi (2004) found similarities between AS and NVLD; however, their AS sample did not resemble the characteristic math deficits seen in many NVLD samples. Klin and colleagues (1995) found a high degree of concordance between AS and the NVLD neuropsychological profile, suggesting that Rourke's NVLD model adequately describes the neuropsychological assets and deficits of individuals with AS.

Like children with NVLD, children with AS also experience attention problems. In fact, many children are often initially referred for assessment due to attentional concerns. Klin and Volkmar (1997) proclaim that such attention problems are related to difficulty with selective attention and inhibition rather than generalized distractibility. Although co-morbidity rates are not documented, the DSM-IV (APA, 2000) notes that ADHD is frequently associated with an Asperger's Disorder diagnosis.

Similar to the white-matter deficit model used to explain NVLD, Tsatsanis and Rourke (1995) suggest this model applies to AS as well. Also similar to NVLD, is the neurobiological explanation of the disorder which purports a developmental abnormality of the right cerebral hemisphere (McKelvey, Lambert, Mottron, and Shevell, 1995).

Thus, with similar neuropsychological patterns of functioning and evidence for similar neurobiological origins of the disorder, it appears that AS and NVLD are comparable, if not indistinguishable, disorders. The diagnostic criteria for each continues to be debated making them difficult to separate in a clinical setting. In addition, although HFA has some overlapping features with AS and NVLD, evidence favors distinct classification from the latter two. The current study will operate under the thesis of several researchers who use Rourke's (1989) NVLD model as a theoretical framework that encapsulates AS (Gunter, Ghaziuddin, & Ellise, 2002; Klin, Volkmar, Sparrow, Cicchetti, & Rourke, 1995). Thus, NVLD and AS participants will collectively compose one of the three diagnostic groups in this study and will be referred to as the NVLD/AS group.

The previous sections have outlined cognitive and academic functioning related to NVLD/AS. Just as important, however, is the child's social and emotional functioning. Although yet to be empirically proven, it appears that the social and emotional problems observed in children with NVLD and AS are related to the neuropsychological profile indicative of the disorder (Petti et al., 2003; Rourke, 1989; Semrud-Clikeman & Hynd, 1990). In particular, the visual-spatial deficiency acts as the precursor to social perception problems, social skills deficits, and finally socioemotional dysfunction. The next sections will describe each of these constructs and their relation to internalized socioemotional dysfunction.

Visual-Spatial Skills

DEFINITION

Linn and Peterson (1985) delineate three primary components of spatial abilities – spatial perception, mental rotation, and spatial visualization. Dominated by nonverbal

thinking, spatial abilities involve application of visual-spatial skills and visual-motor skills. The right hemisphere of the brain largely controls visual-spatial processes. Performance IQ scores, especially Block Design from Wechsler scales, are widely used as visual-perception dysfunction indicators (Kaufman & Lichtenberger, 2000).

VISUAL-SPATIAL SKILLS AND VERBAL LEARNING DISABILITY

Poor reading ability was once thought to be due to deficits in visual processes. This visual deficit viewpoint has become less popular in recent years as research now links phonological impairments to reading disability. However, some researchers are finding that both visual-spatial and phonological impairments are contributing factors to reading disability (Eden, Stein, Wood, & Wood, 1995). In their study, Eden, Stein, Wood and Wood (1995) showed that students with reading disabilities had difficulty with eye tracking, fixation control and vergence ability. The nature of these deficits is different from that of the visual-spatial deficits commonly found in children with NVLD. Rourke and his colleagues have consistently distinguished LD subtypes based on patterns of language and math ability. The language-based disability group tends to maintain well-developed visual-spatial abilities while having poor auditory-perceptual and language-related abilities (Ozols & Rourke, 1985).

VISUAL-SPATIAL SKILLS AND NVLD

Visual-spatial skills deficits is one of the defining features of NVLD (Harnadek, & Rourke, 1994; Rourke, 1989). The math deficits that are present among children with NVLD are related to visual-spatial deficits (Forrest, 2004; Rourke, 1982). These visual-spatial deficits lead to difficulty with the following math skills: forming numbers, number column alignment, directionality, general organization of work, and reading calculation signs. Several studies have provided empirical evidence for the visual-spatial deficits

among children with NVLD when compared to children with verbal disabilities, children with ADHD, and children without a disability. Children with NVLD have performed significantly more poorly when asked to determine the position of objects in space (Forrest, 2004); on verbally-presented spatial reasoning tasks (Worling, Humphries, & Tannock, 1999); on visual-spatial-organizational tasks (Woods, Weinborn, Ball, Tiller-Nevin, & Pickett, 2000); and on visual-motor integration (Wilkinson, Schafer, & Semrud-Clikeman, 2002). Social implications for these deficits involve difficulty with perceiving their spatial distance from other children and subsequently standing too close to a peer (Forrest, 2004). Additionally, they may have difficulty with spatial elements of their environment. When visual-spatial deficits are severe, attending to these deficits should be the main focus of treatment and intervention (Forrest, 2004).

VISUAL-SPATIAL SKILLS AND ADHD

An association between ADHD and visual-spatial deficits has not been suggested in the literature. The attention and behavioral issues that characterize such children have little relation to visual-spatial processes. In a study by Wilkinson, Shafer, and Semrud-Clikeman (2002), children with ADHD demonstrated visual-spatial skills that were superior to those of children with NVLD.

Social Perception

DEFINITION

Children's deficits in social competence may be influenced by many factors including a performance or skills deficit in social perception. Defined by Myklebust (1975, p. 96) as "the child's ability to understand his social environment, especially in terms of his own behavior", social perception is a necessary component to successful social functioning. Social perception involves the ability to attend to, register, and

interpret the verbal and nonverbal social cues through vision, hearing, and touch (Morrison & Bellack, 1981). Semrud-Clikeman and Hynd (1991) delineate three components of social perception. The first component is recognizing and labeling emotion. The second feature is prosody, or the ability to express and understand underlying components of language. The third component is the understanding of facial expressions and gestures. It is difficult to accurately interpret verbal information without attendance to the accompanying nonverbal information that is concurrently conveyed. When a child is not able to successfully evaluate social situations and act appropriately based on these perceptions, social incompetence results (Custrini & Feldman, 1989; Edwards, Manstead, & MacDonald, 1984; Feldman, White, & Lobato, 1982). Due to increased cognitive ability, social perception is a developmental skill that has been shown to improve with age (Nowicki & Duke, 1994; Rosenthal, Hall, DiMatteo, Rogers, & Archer, 1979).

SOCIAL PERCEPTION AND LD SUBTYPES

Several research studies have demonstrated the social perception deficits in individuals with learning disabilities (Axelrod, 1982; Reiff & Gerber, 1990; Wiig & Harris, 1974). Most studies, however, have not differentiated the various LD subtypes and therefore generalizations have been made about the heterogeneous disability group. These studies allude to visual-spatial deficits as a precursor to such deficits (Dir, 1999). Reiff and Gerber (1990) suggest that deficits in cognitive mechanisms of analysis and synthesis mediate the ability to tune in to social situations. These individuals have difficulty making central inferences and therefore misinterpret social situations.

Ozols and Rourke (1985) have demonstrated performance differences among two LD subtypes on tasks of social sensitivity. The two groups consisted of: (a) a language disorder group composed of children who have poor auditory-perceptual and language-

related abilities in conjunction with well-developed visual-spatial abilities and (b) a spatial disorder group composed of children who are deficient in visual-spatial organization and synthesis while advanced in auditory-perceptual and language-related abilities. As expected, the language disorder group performed better on tasks requiring nonverbal responses while the spatial disorder group performed better on tasks requiring verbal responses. For example, children in the spatial disorder group had more difficulty understanding pictures depicting various social situations as compared to those in the language disorder group.

SOCIAL PERCEPTION AND NVLD

Myklebust (1975) and Rourke (1989) have written about the social perception deficits in children with NVLD. Empirical evidence exists for this claim that children with NVLD are deficient in social perception. Individuals with NVLD are less successful in interpreting facial expressions and gestures as compared to VLD and control groups (Dimitrovsky, Spector, Levy-Shiff & Vakil, 1998; Petti et al., 2003). In another study, a set of identical twins were evaluated – one twin had brain lesions and a neuropsychological profile suggesting NVLD while the other twin was without lesions and had a relatively normal profile (Woods, Weinborn, Ball, Tiller-Nevin, & Pickett, 2000). The twin showing the NVLD pattern of assets and deficits demonstrated internalized socioemotional problems as well as deficits on the WISC-III Picture Arrangement subtest suggesting deficits in social perceptual functioning. Similar results were found in a study that demonstrated that children with nonverbal learning disabilities were less accurate at encoding nonverbal social cues (Sweet Nichols, 1998). They had particular difficulty with more dynamic, as compared to static, social stimuli. In another study, children with NVLD, as compared to children with VLD, demonstrated significant

problems in social perception and a non-significant trend toward more social skills deficits (Petti et al., 2003).

Functional magnetic resonance imaging indicates that children with NVLD utilize different neural structures when interpreting facial expressions (Vallabha, 2003). Specifically, such individuals displayed less activation, compared to normal controls, in limbic areas that govern emotion processing. Instead they used other brain structures largely responsible for language functioning, a strength that they appear to rely on (Vallabha, 2003).

SOCIAL PERCEPTION AND ADHD

Compared to students with ADHD or no disability, students with LD demonstrated deficits on the DANVA-Facial Expressions task (Sprouse, Hall, Webster, & Bolen, 1998). Although students with ADHD did not exhibit social perception deficits on the DANVA, teachers rated them as having deficits in social perception. Thus, students with ADHD seem to have the ability to interpret nonverbal cues correctly, but they have more difficulty following through with the appropriate behavior. Therefore a performance or self-control deficit is suggested to explain their social skills difficulties (Sprouse et al., 1998).

Social Skills

DEFINITION

Gresham and Elliott (1984) define social skills as socially acceptable learned behaviors that enable individuals to interact with others and avoid socially unacceptable responses. Social skills compose one set of skills that make up the broader construct known as social competence (Vaughn & Hogan, 1994). Other components of social competence in Vaughn and Hogan's (1994) theoretical model include peer relationships,

social cognition and absence of maladaptive behavior. It is plausible that these components are interrelated (Bryan, 1994). Various domains of social skills include cooperation, responsibility, assertiveness, self-control, problem solving, and recognizing and dealing with feelings (Gresham & Elliott, 1990; Pfiffner & McBurnett, 1997).

SOCIAL SKILLS AND LD

In addition to deficits in specific academic areas, students with LD often have deficits in social skills. In a review of research, Gresham and Elliott (1989) state that children who are learning disabled are between 1 and 2 standard deviations below students who are not disabled on measures of social skills. Such social deficits result in poor acceptance by peers (Gresham & Reschly, 1988). Therefore these children have difficulty with the establishment and maintenance of successful relationships with adults and peers. There are varying views on the origins of such deficits. The first is that these deficits result from central nervous system dysfunction. The second hypothesis is that social skills problems are secondary to academic problems (Gresham & Elliott, 1989). A third hypothesis is based on Bandura's (1977) social learning theory which suggests that problems may be the result of acquisition or performance deficits.

SOCIAL SKILLS AND NVLD

Studies on social skills within the NVLD population have been done within the context of the overarching construct of socioemotional problems. These studies, which will be reviewed in greater detail in the socioemotional functioning section, have shown a consistent pattern of individuals with NVLD having greater social skills problems when compared to other disability groups and non-disabled children (DeLuca et al., 1991; Landau et al., 1999; Rourke, 1989).

SOCIAL SKILLS AND ADHD

Social problems among children with ADHD are well documented (Landau & Moore, 1991). These children often experience negative peer interactions as youngsters and long into adulthood due to the nature of their disability. Some believe that this unfavorable peer status is the result of both skill and performance deficits (Guevremont & Dumas, 1994); whereas others believe it is primarily the result of performance deficits. It has been shown that such individuals do not significantly differ from non-disabled peers in specific social skills such as social perspective-taking (Ackerman, Elardo, & Dykman, 1979; Campbell & Paulauskas, 1979) and social cognition (Henker & Whalen, 1989). Social communication skills, however, is an area where these children appear to be deficient (Guevremont & Dumas, 1994; Landau & Milich, 1988).

Most studies do not differentiate ADHD subtypes when discussing social skills. Some researchers have attempted to find meaningful differences between the predominately hyperactive group and inattentive group. However, the evidence that the social problems experienced by ADHD children are dependent on the subtype is equivocal. It is possible that children with ADHD: Predominately Inattentive Type experience more social withdrawal as compared to their ADHD: Predominately Hyperactive counterparts (Edelbrock & Costello, 1984; Lahey et al., 1984).

Socioemotional Functioning

TYPICAL SOCIOEMOTIONAL DEVELOPMENT IN CHILDREN

Researchers contend that emotional responses are based partly on learning ("nurture") and partly on biology ("nature") (Hyson & Izard, 1985). Temperament and psychological development are believed to be natural factors. Nurturing factors include environment, learning, culture, and parenting/attachment styles. According to Saarni

(1999) the acquisition of emotional competence skills (e.g., emotional awareness of self and others, emotional expressiveness, empathy, self-regulation in times of stress, emotional self-efficacy) has two effects. The first effect is emotion management. Children learn strategies for emotional expression and how to manage emotions internally and externally according to the present situation. Second, with the development of emotional competence, children's self-esteem is validated and reinforced.

In addition to nature and nurture influences on the formation and maintenance of relationships, Selman, Levitt, & Schultz (1997) postulate that that there is a third integrative influence – psychosocial development. Psychosocial development has been described as "the internal psychological processes of interpersonal understanding, skills, and values that comprise an individual's capacity for interpersonal relationship, including friendships" (p. 35). The development of friendships with peers is found within the context of four psychosocial development stages that encompass the child's desire to seek companionship with others (Rice, 1997). The force of psychosocial development, however, may play little or no part in the social outcomes of the child if the nature and/or nurture forces are overwhelmingly strong. (Selman et al., 1997). This may be the case for children with NVLD whose "nature" may overwhelm their acquisition of social learning through their environment.

ASSESSMENT OF SOCIOEMOTIONAL FUNCTIONING

Adults typically serve as their own informants to the clinician regarding their emotional states. Affective assessment of children is different as they are often inaccurate in their reports of their own behavior. Thus, it becomes the responsibility of caregivers and teachers to inform the clinician of observed behaviors that are indicative of emotional/behavioral disturbance. Assessment of this nature should include interviews and rating scales. The advantages of rating scales are that they are time-efficient, broad,

objective, and inclusive of behavior across settings (Reynolds & Kamphaus, 1992). When behavior-rating scales are given to multiple informants for the same child, inconsistent reports may occur. Adolescents report more emotional and behavioral problems than their parents or teachers (Sourander, Helstelä, & Helenius, 1999; Stanger & Lewis, 1993). An informant's rating of a child is dependent on their relation to the child and the behavior being rated (Stanger & Lewis, 1993). For example, there are several factors that influence teachers' ratings of their students. Elementary teachers who spend the entire day with the child are better informants than high school teachers who may see the child for only an hour per day. Teachers' frames of reference in which they use to compare the behaviors of children can also be influential. Special education teachers may have skewed perceptions of a child's behavior. Due to the requirement of the classroom, teachers are typically better sources of information of externalizing behavior, including attention problems and overactivity (Reynolds & Kamphaus, 1996). Children may be more likely to exhibit externalizing behaviors in the classroom where they are more readily observable by the teacher. On the contrary, parents may be better informants of internalizing problems. At home, children may be more likely to display internalizing problems among the safety of their parents. It is for this reason that teachers may report fewer internalizing problems than parents (Stanger & Lewis, 1993).

SOCIOEMOTIONAL FUNCTIONING AND LEARNING DISABILITIES

In addition to having difficulties with specific subject areas in school, some children with LD may experience social skills and/or socioemotional dysfunction. It has been shown that children with LD are more likely to be rejected and neglected by their peers regardless of their IQ or achievement (Weiner, Harris, & Shirer, 1990). Furthermore, in a review of recent literature, Greenham (1999) reports that children with

LD tend to receive lower peer status ratings, are less socially competent, and have social-cognitive difficulties.

Several hypotheses have been formed regarding the origins of such socioemotional disturbances in students with learning disabilities (Rourke, 1988). The first hypothesis is that conflicts within the learning environment limit the academic progress of students. Second, it is hypothesized that a cycle is created upon the initiation of the child's school failure that elicits negative feedback from the child's parents, teachers, and peers. This in turn influences their failure to make advances in learning. The cycle continues with pressure and subsequent negative feelings that eventually lead to social and emotional problems (Bruck, 1986). Finally, the third hypothesis is that specific patterns of central processing abilities and deficits (i.e., specific learning disability subtype) cause specific forms of socioemotional disturbance.

Psychosocial Subtyping Research.

Extensive research has been conducted by Rourke and his colleagues in an effort to differentiate clinic-referred students with learning disabilities on the basis of psychosocial functioning. Results of their research using the Personality Inventory for Children have yielded support for at least five consistent and replicable subtypes – normal, somatic complaints, mild anxiety, externalized psychopathology, and internalized psychopathology (Fuerst, Fisk, & Rourke, 1990; Fuerst & Rourke, 1991, 1993, 1995; Porter & Rourke 1985; Tsatsanis & Fuerst, 1997). Over half of the participants in each of these studies exhibited normal psychosocial functioning. The rest of the participants fit the profile of clinically significant psychosocial disturbance. It appears that psychosocial functioning of children with learning disabilities is related to patterns of cognitive functioning (Fuerst et al., 1990) and patterns of academic achievement (Fuerst & Rourke, 1993). Specifically, children who exhibit the VIQ>PIQ pattern of cognitive abilities and

likewise have well-developed reading and spelling skills are more likely to appear in psychosocial subtypes with profiles suggestive of internalized or externalized psychopathology.

Although extensive research has been conducted on both broad domains of socioemotional functioning (i.e., externalizing and internalizing), the focus of this paper remains on the relationship between internalizing problems and learning disabilities. Although evidence exists to the contrary (e.g., Epstein, Bursuck, & Cullinan, 1985) it has been suggested that, in general, students with LD experience more internalizing than externalizing problems (Nussbaum, Bigler, & Koch, 1986). Most research has been conducted within the domains of two internalizing disorders – anxiety and depression.

Anxiety and Depression

Several research studies have demonstrated that students with LD experience higher levels of anxiety than students without LD (Dollinger Horn, & Boarini, 1988; Epstein et al., 985; Epstein, Cullinan, & Lloyd, 1986; Margalit & Raviv, 1984; Margalit & Shulman, 1986; Margalit & Zak, 1984; Paget & Reynolds, 1984; Ritter, 1989; Stein & Hoover, 1989). Such anxiety may manifest itself in the form of minor somatic complaints as a means by which to elicit adult support and assistance (Margalit & Raviv, 1984).

Similar to research on anxiety and LD, there is also an abundance of research linking depression to learning disabilities (Baron, 1989; Brumback, Staton, & Wilson, 1980; Cohen, 1992; Colbert, Newman, Ney, & Young, 1982; Goldstein, Paul, & Sanfilippo-Cohen, 1985; Gregg, Hoy, King, Moreland, & Jagota, 1992; Heath, 1992; Howard & Tryon, 2002; Livingston, 1985; Maag & Behrens, 1989; Stevenson & Romney, 1984; Tistan, 1993; Wright-Stawderman & Watson, 1992). Although the results are equivocal (Bender, Rosenkrans, & Crane, 1999), most of these studies have found that students who are learning disabled tend to exhibit depressive symptoms at higher

levels than their non-disabled peers. Goldstein et al. (1985) found that lower levels of both math and reading achievement were significantly correlated with higher levels of depressive symptomology.

Developmental Course of Socioemotional Functioning for Individuals with LD

Cohen (1986) conducted a clinical investigation regarding the personality development of children with LD. He asserts that "a learning disability is initially only one developmental element . . . that sets in motion a series of on-going psychological processes that may become interrelated with various aspects of psychological and social functioning and development" (p. 298). Specifically, a chain of events starts with the learning disability symptoms that interfere with functioning in an inconsistent, intermittent manner which contribute to the child's belief that frustration and failure are unpredictable and uncontrollable. The presence of such negativity then leads to a lowered self-esteem, distress, anxiety, humiliation and a sense of loss. This process is thought to be gradual and appears with subtlety in the mid-latency years or later.

Contrasting the belief that children with LD are victims of a "self-perpetuating failure cycle" (Tsatsanis & Fuerst, 1997, p. 490), it also has been suggested that with increasing age, psychosocial functioning of children and adolescents with LD either improves due to greater acceptance and understanding of the disorder, or functioning remains relatively stable (Fuerst & Rourke, 1995). These latter authors conclude that children with LD ages 7 to 13, as a whole, do not become more susceptible to socioemotional disturbance with increasing age. Instead they propose that factors other than age and cumulative exposure to negative experiences may contribute to the development of psychosocial problems. Such factors, they suggest, may be the pattern of neuropsychological assets and deficits that comprise the NVLD syndrome.

Suicide Risk

Students with LD may be at greater risk for suicide as compared to non-disabled peers (Hayes & Sloat, 1988; McBride & Siegel, 1997; Peck 1986). One study showed that children and adolescents with LD were involved in suicide-related occurrences at higher rates than non-disabled adolescence (Hayes & Sloat, 1988). In another study, half of the victims of suicide were found to have learning disabilities identified by their local school district (Peck, 1986). Bender and colleagues (1999), offer two reasons why students with LD may demonstrate an increased risk of suicide. First, the increasing levels of stress experienced by students with LD coupled with growing social-emotional problems can lead to higher rates of depression. As cited previously, students with LD have been shown to suffer from higher rates of depression than nondisabled students. Because depression is a significant correlate of suicide (Pfeffer, 1986), this population seems to demonstrate a greater risk for the tragic outcome (Bender et al., 1999). A second reason is that the characteristics that are inherent in the disorder (e.g., impulsivity, deficits in self-concept, nonverbal problem solving, less developed cognitive ability to relate to causes and consequences) may predispose them to suicidal behavior. As will be discussed later, it may be that children with one learning disability subtype (i.e., NVLD) experience the greatest susceptibility to suicide due to the characteristics inherent in the disorder (Rourke et al., 1989).

Research Issues Related to LD and Socioemotional Functioning Literature.

Gresham and Reschly (1988) attest that learning disabilities and social functioning difficulties do not originate from the same neurological dysfunction and that such difficulties are not unique to this particular disorder. Social functioning difficulties are also present in children with behavior disorders and mild mental retardation. Mokros,

Poznanski, and Merrick (1989) were unsuccessful in supporting the hypothesis that links learning problems to a sole socioemotional manifestation - depression.

There are several factors in this literature that lead to contradictory conclusions. For example, most of the studies are characterized by use of normative data to compare scores of the clinical group. A necessary change to these studies is to directly compare LD to a non-LD group. A study by Maag, Behrens, & DiGangi. (1992) found no difference in severity of depression when these two groups were compared. Another factor that may influence results is instrumentation. For example, measures of depression can vary from ones that examine severity of depressive symptomatology to ones that assess both severity and symptom duration. Also, items on rating scales do not necessarily meet DSM-IV criteria for depression (Maag & Reid, 1994). Variations in participant characteristics can lead to various outcomes. For example, clinic-referred children may represent more extreme symptoms than non-clinic referred children (Maag & Reid, 1994). Another example of participant variation is demonstrated by Howard and Tryon (2002) who found that students with LD in general education classrooms were more depressed than students with LD in self-contained classes.

Another limitation in previous research has been a failure to differentiate individuals with LD into subtypes (Rourke, 1988). Researchers have found remarkable differences when an entire population of students with LD is differentiated into various subtypes (Fuerst, Fisk, Rourke , 1990; Fuerst & Rourke, 1991, 1993, 1995; Nussbaum, Bigler, & Koch, 1986; Porter & Rourke 1985, Tsatsanis & Fuerst, 1997). Another research flaw has to do with the assumption that significant findings between two or more groups indicates dysfunction by one group. In other words, statistical significance is not necessarily synonymous with clinical significance. Greenham (1999) has reviewed several studies that have found significant differences between LD and non-LD samples

on measures of depression, yet the scores fell within normal limits and were not indicative of clinically significant levels of depression. Also, the prevalence rates of depression in some studies do not significantly differ from the general population (Greenham, 1999). Maag and Reid (1994) found equal prevalence rates of depression (10%) in their sample of students with and without LD. Another faulty component of previous studies is the few attempts that have been made to control for the co-occurrence of other problems or diagnoses. For example, Hynd et al (1995) and Lyytinen (1995) claim that ADHD is likely to influence psychosocial functioning. Still other criticisms of previous research are a lack of consensus on the definition of psychosocial dysfunction and the use of a variety of checklists that makes direct comparisons between them difficult (Greenham, 1999).

SOCIOEMOTIONAL FUNCTIONING AND VERBAL LEARNING DISABILITIES

There have been few studies that specifically examine verbal learning disabilities and socioemotional functioning. Results indicate mixed outcomes -- that children with verbal deficits exhibit more externalizing problems (McGee, Williams, Share, Anderson & Silva, 1986), more internalizing problems (Nussbaum et al., 1986) or normal psychosocial functioning (Pelletier et al., 2001; Strang & Rourke, 1985).

SOCIOEMOTIONAL FUNCTIONING AND NVLD

As previously mentioned, it has been hypothesized that a pattern of central processing abilities and deficits dictate certain patterns of socioemotional functioning (Rourke, 1988). Specifically, it has been suggested that individuals with NVLD have a greater disadvantage for the development of social problems because they lack the perceptual and cognitive skills that are necessary for effective social functioning (Ozols & Rourke, 1985). Their social dysfunction may be related to difficulties with

interpretation of emotional expression or other social perception deficits (Dimitrovsky et al., 1998). Rourke (1989) conceptualizes that specific socioemotional problems are due in part to the neurological profile that make up the disability (see Table 1). Practical examples of social problems among children with NVLD include: difficulty with novel or unstructured social situations, not understanding or utilizing nonverbal gestures and communication, being rather verbose, and failing to understand or utilize contextual aspects of communication. Their underdeveloped psychomotor skills limit their participation in games with peers. As a result of their communication style and lack of interaction, negative feedback is often elicited by peers (Strang & Rourke, 1985).

Table 1: Interaction of Assets and Deficits as Contributors to Socioemotional Problems.

Socioemotional Deficits	**Neuropsychological Asset/Deficit contributors**
Social judgment	Problems in reasoning, concept formation
Facial recognition and emotional expression	Difficulties with visual-spatial-organizational skills
Peer acceptance	Language used: lack of prosody, verbosity, dull, drab, colorless statements
Smooth intimate encounters	Tactile-perceptual and psychomotor problems
Adaptability to novel interpersonal situations	Poor problem-solving and hypothesis-testing skills

Strang and Rourke (1985) provide support for this hypothesis in their comparison of children with NVLD characteristics and children with linguistically based learning disabilities on the Personality Inventory for Children (Writ, Lachar, Klinedinst & Seat, 1977). Whereas the linguistically-based learning disability group had average personality profiles, the NVLD group had personality profiles suggestive of the presence of an internalized form of psychopathology (i.e., psychosis, social skills, anxiety, withdrawal,

and depression). In another study, children with NVLD were twice as likely as children with VLD to have internalizing emotional problems (Petti et al., 2003).

In a related study, researchers differentiated a group of children exhibiting arithmetic impairments (one indication of NVLD) on the basis of personality functioning (DeLuca et al., 1991). Children exhibiting similar characteristics as the NVLD subtype had their highest ratings on Personality Inventory for Children scales reflecting internalized psychopathology (Depression, Withdrawal, Anxiety, Psychosis, and Social Skills)

Supporting evidence for the hypothesis that children with NVLD experience more social problems has been found among a small sample of children with brain tumors who exhibited the NVLD neuropsychological profile. The results of radiation therapy, a medical intervention known to damage white matter, may have been the cause of such neuropsychological effects (Burger & Boyko, 1991). These children's parents reported significant social deficits and a non-significant trend for internalizing problems. Neither the children themselves nor their teachers, however, reported social or emotional problems.

In addition to being more severely socially impaired than children with VLD, children with NVLD have also demonstrated greater impairments when compared to students with ADHD. Individuals who exhibited the NVLD pattern were more severely impaired on scales related to internalizing disorders (i.e., withdrawal, somatic problems, and social problems) when compared to individuals with ADHD and with no disability label (Landau et al., 1999).

Developmental Progression of Socioemotional Functioning in Children with NVLD.

Rourke proposes that children with NVLD initially exhibit more acting out behaviors than internalizing behaviors. This finding was seen in a group of children, aged

7-8 resembling NVLD, who exhibited more conduct problems than other students with learning problems (Ozols & Rourke, 1991). The developmental course calls for a decrease in hyperactivity and other acting out behaviors, and an increase in internalizing problems. This shift, Rourke proposes, occurs in late childhood or early adolescence, and was demonstrated in a study by Casey, Rourke, and Picard (1991). Pelletier, Ahmad, & Rourke (2001) found that as children with NVLD become older, they exhibit a trend towards increasing internalized psychopathology. It has been strongly suggested that the adaptive difficulties that plague children with NVLD may have detrimental effects over time and may possibly predispose them to suicide risk (Rourke, Young, & Leenaars, 1989). Their adaptive difficulties all have social implications including clumsiness, proximity in social interactions, reliance on verbal mode of interaction, and understanding nonverbal cues and emotional states of others. It is proposed that such experiences encourage withdrawal or eventual isolation and depression. These effects are carried throughout adolescence (Del Dotto, Rourke, McFadden, & Fisk, 1987) and adulthood (Del Dotto et al., 1987; Rourke, Young, Strang, & Russell, 1986) where the latter age group experience difficulties in their professions, recognizing and dealing with their problems, and nonverbal aspects of communication (Rourke et al., 1989).

Research Issues with NVLD and Socioemotional Functioning Literature.

There is some evidence that contradicts the theorized link between NVLD and socioemotional difficulties, particularly of the internalized kind. For example, there is evidence that children with verbal deficits, instead of nonverbal deficits, are more susceptible to socioemotional problems. In a study by Glosser and Koppel (1987) children identified with learning problems were categorized based on lateralized cognitive impairments (i.e., right versus left hemisphere cognitive impairments). Contrary to what was expected based on the theory of right-hemisphere functions,

children with right-hemisphere impairments had fewer reports of depression/anxiety than children with left hemisphere impairments (thought to be related to language functions). In another study, children with lower verbal skills had higher reports of internalizing problems (Nussbaum et al., 1986). Bender and Golden (1990) conducted a subtypal analysis of students with perceptual impairments and found that the subtype that resembled Rourke's NVLD syndrome was characterized by a high frequency of externalized behavior problems instead of internalized problems (Bender & Golden, 1990).

Even with years of exploring the complex relationship between socioemotional functioning and patterns of cognitive strengths and weaknesses, Rourke and his associates say, "our current understanding . . .is primitive at best" (1991, p. 306). In her review of the literature from the past twenty years, Little (1993) concluded that there is much to be learned about the relationship between nonverbal learning disabilities and socioemotional dysfunction. Several research design flaws and methodological issues have contributed to the inconclusiveness of the existing data. Although research exists that supports the hypothesis that individuals with NVLD are more prone to socioemotional dysfunction, such research fails to report the inclusion of comparisons to nondisabled control groups (e.g., Weintraub & Mesulam, 1983; Rourke, Young, Strang, & Russell, 1986; Casey & Rourke, 1991). Other research examples draw conclusions from data involving a small number of participants. For example Del Dotto et al., (1991) drew conclusions from their sample of only five participants. The incidence of NVLD is significantly lower than other LD subtypes making participant recruitment relatively more challenging; however, adequate and representative samples of the disability under investigation is still important in order to safely form conclusions and generalizations.

In a critique of Casey, Rourke and Picard's (1991) study, Little (1993) cited two other factors that affect generalizability -- gathering data retrospectively and classifying participants on the basis of clinical judgment as opposed to cluster analysis. Furthermore, Little urges caution in generalizing the works of Rourke and his colleagues (e.g., Fuerst et al., 1990; Rourke & Fuerst, 1992) as that work was based on parent ratings and consisted of upper-lower class to middle class urban/suburban children who were diagnosed by clinical neuropsychological measures. The results of these studies may not be generalizable to children referred for assessment in school settings with different sociocultural compositions and where teacher reports replace the parent reports used in the studies. Researchers in Rourke's laboratory (e.g., Pelletier et al., 2001; Tsatsanis and Fuerst; 1997) also offer cautionary statements for their studies involving clinic-referred participants, stating the influential effects of referral bias and possible over-represented presence of psychosocial dysfunction. At the time of assessment, clinic-referred students typically are experiencing multiple or more serious problems than school-referred students. Thus, given the various problems with previous research, "the relationship between learning disabilities subtypes and socioemotional dysfunction should be regarded cautiously and investigated further" (Little, 1993, p. 659). "It is important to obtain convergent evidence from studies that include school-based samples of children with subtypes of LD and appropriate comparison groups" (Greenham, 1999).

SOCIOEMOTIONAL FUNCTIONING AND ADHD

It is estimated that over 50 percent of children with ADHD have problems in peer social relationships due to inappropriate levels of inattentiveness, impulsivity, and hyperactivity and significantly higher levels of life stressors (Pelham & Bender, 1982). Their attention problems are likely to cause chronic school failure and peer relationship

problems that subsequently lead to depressive and anxious symptoms (Jensen, Shervette, Xenakis, & Richters, 1993).

There is a strong relationship between ADHD and depression (Biederman, Faraone, Mick, Lelon, 1995; Bohline, 1985; Landau et al., 1999; Staton & Brumback, 1981). One study suggests ADHD may be a precursor to adult depression (Swenson, McIntyre, Swinson, & Kennedy, 2001). Even when overlapping symptoms of both ADHD and depression (i.e., psychomotor disturbance and diminished ability to concentrate) were not considered when assessing for the presence of depression, research participants maintained their diagnosis of major depression. These findings suggest that neither ADHD nor major depression is an artifact of the shared conditions (Biederman et al., 1995; Milberger, Biederman, Faraone, Murphy, Tsuang, 1995).

It is estimated that at least 30 to 60 percent of children and adolescents with ADHD continue to have the disorder in adulthood (Shelton & Barkley, 1999) although symptom manifestations may change (Barkley, 1990). The co-occurrence of ADHD and Major Depressive Disorder, dysthymia, or bipolar disorder in adults is 15% to 75% (Alpert et al., 1996; Biederman, et al., 1995; Carlson, 1998). Difficulties associated with ADHD in adulthood may be evidenced as internalizing problems such as interpersonal problems, depression, or externalizing problems including criminal activities or drug abuse (Farrington, Loeber, & van Kammen., 1987; Loney Whaley-Klahn, Kosier, & Conboy, 1981).

Some researchers have been able to differentiate socioemotional functioning among the various subtypes of ADHD (i.e., Predominately Inattentive Type, Predominately Hyperactive-Impulsive, Combined Type) while others contend that the differences are insignificant. Researchers consistently find more aggression (Lahey, Schaughency, Hynd, Carlosn, & Nieves, 1987; Maedgen & Carlson, 2000) and overall

greater social impairment among ADHD subtypes with hyperactivity versus ADHD: Predominately Inattentive Type (Gadow et al., 2004). However, it is possible children with ADHD: PI exhibit higher rates of internalizing problems as compared to other ADHD subtypes. A study by Lahey and colleagues (1987) revealed that students with ADHD: PI were more likely to receive a codiagnosis of depression and anxiety or affective disorder (Lahey et al., 1987). Students with ADHD: PI may display more social passivity and deficits in social knowledge as compared to ADHD: Combined Type (Maedgen & Carlson, 2000). If this is indeed true, differential treatment and intervention are warranted. Maedgen and Carlson (2000) suggest, for example, that children with ADHD: PI may benefit more from a treatment approach that reinforces assertive behavior and encourages more social interactions.

Contrary to studies that differentiate ADHD subtypes on the basis of socioemotional functioning, Eiraldi, Power, and Nezu (1997) demonstrated that the level of internalizing problems did not depend on the ADHD subtype. Similarly, Power and colleagues (2004) provided evidence that children with ADHD: PI and ADHD: Combined Type had levels of anxiety and depression that were not significantly different from each other. Thus, it has yet to be determined whether significant differences in socioemotional functioning exist among the various ADHD subtypes.

Linking the Four Constructs

Thus far, literature regarding the four constructs under investigation (visual-spatial skills, social perception, social skills, internalized socioemotional functioning) has been reviewed. To summarize, children with NVLD and AS have demonstrated impairments in all four of these constructs. The hypothetical link between these various domains of impairment is the current focus.

As evidence for the link between visual-spatial skills and social perception, researchers have shown that children with spatial deficits have more difficulty understanding pictures depicting various social situations (Ozols & Rourke, 1985) and encoding nonverbal social cues (Sweet Nichols, 1998). Deficits in visual-spatial processes is the probable source of such difficulties in social perception for children with NVLD (Semrud-Clikeman & Hynd, 1990; Sweet Nichols, 1998).

The link between social perception and social skills is evident in studies that conclude that individuals who are able to take another's perspective and interpret facial expressions tend to be more popular and have more positive peer relationships (Kurdek, 1985; Nowicki & Duke, 1992). "These results, which support the importance of the role of nonverbal communication in the interpersonal functioning of children, are consistent with the view that children who do not interpret nonverbal information accurately must handle accumulated negative reactions that may predispose them to develop personal and interpersonal difficulties" (Nowicki & Duke, 1992, p. 390). Custrini and Feldman (1989) also assert that there is a "connection between nonverbal communicative skills and social effectiveness" (p. 337). Barton and colleagues (2004) found that individuals with social and developmental disorders, including Asperger's Syndrome, high-functioning autism and NVLD features, have facial identity processing impairments that include both perceptual and associative deficits. Their findings also suggest that social dysfunction of these individuals may be secondary to either neural deficits or perceptual deficits that are common to these diagnostic groups. The authors discuss the difficulty in determining the nature of the relationship between perceptual deficits and social dysfunction. The explore two possibilities – 1) a causal relationship in which the social dysfunction stems directly from perceptual deficits, or 2) a "bystander" relationship whereby perceptual deficits and social dysfunction stem from neurological dysfunction that is in regions of the brain that

are in close proximity (Barton et al., 2004; p. 1715). The temporal lobe, for example, which is largely responsible for visual processes has also been implicated in autism (Damasio & Maurer, 1978).

Finally, there is evidence for the link between social skills and internalized socioemotional functioning. Studies have shown that children who constantly experience negative peer interactions, one indicator of social skills deficits, are likely to be plagued by higher levels of loneliness and worry (Crick & Ladd, 1993; Parkhurst & Asher, 1992). Thus, it is plausible that children with NVLD/AS, due to their social awkwardness, ostracism and ridicule by peers, are especially susceptible to elevated levels of isolation and sadness.

Statement of the Problem

Children with learning disabilities are more susceptible to social problems. However, not all children with LD experience social problems. Thus, it is necessary to determine what factors contribute to such dysfunction in some children with this disability and not in others. Rourke's (1989) theory proposes that it is the neuropsychological pattern of assets and deficits of one LD subtype, namely NVLD, that prompts such social and emotional dysfunction. Specifically, it is the position of others (e.g., Dir, 1999; Petti et al., 2003; Semrud-Clikeman & Hynd, 1990) and this study that the visual-spatial deficits predispose children with NVLD to greater social problems and internalized socioemotional problems. Although the other disability groups under investigation in this study (i.e., VLD and ADHD: PI) have collectively shown the potential for social problems, the nature of NVLD makes children who have this disorder susceptible to a course of social dysfunction that becomes more impaired with time.

NVLD is a disability classification that continues to be refined in terms of clinical features and diagnostic criteria. It is often compared to other autism spectrum disorders—most frequently Asperger's Syndrome. In fact, in many clinical cases, it may be difficult to separate the disorders. This research study will use a combined NVLD and Asperger's sample as the two disorders manifest similar neuropsychological assets and deficits and are thought to be adequately encapsulated by Rourke's (1989) NVLD model (Gunter, Ghaziuddin, & Ellis, 2002; Klin, Volkmar, Sparrow, Cicchetti, & Rourke, 1995).

Methodological flaws of previous research studies in this area have made it difficult to obtain confirmatory empirical data that differentiates individuals with LD on the basis of socioemotional functioning. Thus, it is important to conduct such research studies in order for educators, researchers and parents to have a better understanding of various LD subtypes. It is especially important to have such an understanding, for the purposes of early intervention, as it is thought that internalized forms of psychopathology worsen with age. These socioemotional problems are not inevitable and may be treatable (Pelletier et al., 2001; Rourke & Fuerst, 1996). Thus, it is hoped that this understanding of children with NVLD and their consequential socioemotional problems will prompt the use of appropriate and early interventions that will improve their socioemotional well-being.

Proposed Study

RESEARCH QUESTIONS, HYPOTHESES, AND RATIONALES

Research Question 1

Are there differences among groups on measures of visual-spatial skills, social perception, social skills, and internalizing socioemotional functioning?

HYPOTHESIS 1. It is hypothesized that group differences are present. More specifically, the NVLD/AS group is expected to show impairments on all domains and differ from either the VLD group, ADHD: PI group, or both.

RATIONALE. Visual-spatial skills deficits is a defining feature of NVLD according to Rourke (1989); therefore it is expected that they will show the greatest impairments compared to the other diagnostic groups. Although individuals with VLD have shown visual problems such as tracking or vergence ability, they are less likely to have visual-spatial integration deficits as measured by the task on these tests. Regarding the ADHD: PI group, it has been shown that children with NVLD perform worse than children with ADHD: PI on visual-spatial tasks (Wilkinson et al., 2002).

The NVLD/AS group is expected to show a statistical difference from both the ADHD: PI and VLD groups on the social perception measure. Social perception deficits are included in Rourke's (1989) theory of NVLD. Previous research has shown that individuals with language-based disabilities demonstrate better social perception skills than individuals with nonverbal deficits (Ozols & Rourke, 1985). Although children with ADHD have shown social perception problems, the origin of these problems is believed to be from performance deficits of not following through with what they know is appropriate behavior (Sprouse et al., 1998).

Although children with LD are prone to social skills deficits, it is children with the specific NVLD subtype that tend to show the greatest deficits (DeLuca et al, 1991, Landau et al., 1999; Rourke, 1989; Strang & Rourke, 1985). Children with ADHD also tend to have social skills deficits, however, the origins of their deficits are different from the neurocognitive basis of the NVLD group's deficits (Guevremont & Dumas, 1994). Thus, it is expected that the NVLD/AS group will show statistical differences from the VLD group, but not the ADHD: PI group.

The NVLD/AS group will show greater internalizing problems than the other diagnostic groups as this has been the consensus of prior research (DeLuca et al.; Landau et al., 1999; Ozols, & Rourke, 1985; Pelletier et al., 2001; Strang & Rourke, 1985). This prediction is based on the assumption that social skills deficits that result from the combination of neuropsychological assets and deficits will eventuate in socioemotional problems for children with NVLD. Although children with ADHD: PI and VLD are likely to have elevated levels of socioemotional disturbance as compared to normative standards, such elevations are expected to be less than the elevations by the NVLD/AS group. It is expected that the NVLD/AS vs. VLD and NVLD/AS vs. ADHD: PI comparisons will be significant ($p < 0.05$) and the VLD vs. ADHD: PI will not be significant. Thus, it is expected that children with NVLD/AS will display higher internalizing scores (indicating more problems) than both VLD and ADHD: PI diagnostic groups.

DATA ANALYSIS. Since the social and emotional measures are expected to be intercorrelated, a multiple analysis of variance (MANOVA) will be conducted to test for group differences among the domains. Diagnostic group will be the independent variable and the five dependent variables will be: JLO, CASP-Emotion, CASP-Nonverbal Cues, BASC-Social Skills, and BASC-Internalizing Composite. If statistical significance is

detected, univariate ANOVAs will be conducted using Tukey's Honestly Significant Difference test of comparisons.

Research Question 2

Does the effect of diagnostic group on visual-spatial skills scores depend on age?

HYPOTHESIS 2. An interaction is expected, such that the effects of diagnostic group on visual-spatial skills scores will depend on age. For the NVLD/AS group, visual-spatial skills scores are predicted to worsen with age. Age will not predict visual-spatial skills scores for the ADHD: PI and VLD groups.

RATIONALE. In addition to having visual-spatial deficits, it has been shown that these impairments worsen with age for children with NVLD (Casey et al., 1991). For typically developing individuals, visual-spatial skills are a function of development (Beery, 1997). That is the skill improves as children gets older. Therefore, only the NVLD/AS group is expected to demonstrate the pattern of performance of declining visual-spatial skills.

DATA ANALYSIS. A multiple regression analysis will be conducted using diagnostic group and age as independent variables and JLO scores as the dependent variable. First, JLO scores will be regressed on diagnostic group and age to determine the proportion of variance in JLO scores accounted for by these two variables. A second regression equation will regress JLO scores on the interaction term. A significant change in R^2 will indicate the significance of the interaction between diagnostic group and age on JLO scores.

Research Question 3

Does the effect of diagnostic group on internalizing socioemotional problems depend on age?

HYPOTHESIS 3. Internalizing socioemotional problems will gradually worsen with age for children with NVLD/AS. Age will not affect the ADHD: PI or VLD groups.

RATIONALE. It is expected that the NVLD/AS group will demonstrate an increased level of internalizing socioemotional functioning. Several studies have alluded to the notion that socioemotional problems are exacerbated by the deteriorating skills of children with NVLD (Casey et al., 1991; Pelletier et al., 2001). Children with VLD are expected to follow the pattern suggested by Fuerst and Rourke (1995) in which the socioemotional functioning of students with LD did not deteriorate. The ADHD: PI group is also expected to remain relatively stable.

DATA ANALYSIS. A multiple regression analysis using scores from the NVLD/AS diagnostic group will reveal that age predicts internalizing socioemotional scores, such that, the older these children become, the more internalizing problems they have. First, BASC-Internalizing Composite scores will be regressed on diagnostic group and age to determine the proportion of variance in BASC scores accounted for by these two variables. A second regression equation will regress BASC-Internalizing Composite scores on the interaction term. A significant change in R^2 will indicate the significance of the interaction between diagnostic group and age on BASC scores.

Research Question 4

Do social perception and social skills serve as mediating variables in the relation between visual-spatial skills and internalizing socioemotional functioning in children?

HYPOTHESIS 4. The effect of visual-spatial skills on internalizing socioemotional problems is partially mediated by social perception and social skills.

RATIONALE. It is expected that social perception and social skills will be partial mediators for the relationship between visual-spatial skills and internalizing problems. Visual-spatial skills and socioemotional functioning are thought to share the same

neurological origin in the right cerebral hemisphere (Semrud-Clikeman & Hynd, 1990). It has also been suggested that visual-spatial problems are the bases for subsequent social problems due to the nonverbal nature of social interactions (Dir, 1999; Petti et al., 2003; Semrud-Clikeman & Hynd, 1990). Furthermore, Petti, Voelker, Shore, & Hayman-Abello (2003, p. 33) make the claim that social perception may be the "empirical link" between visual-spatial abilities and socioemotional functioning.

DATA ANALYSIS. The relationship between visual-spatial skills and internalized problems with the predicted mediating variables (social perception and social skills) will be analyzed with a series of regression equations. The Bonferroni technique will be used to control for an inflated Type I error as multiple regression equations will be tested. The significance level for each of the five regression equations will be adjusted to an alpha level of .01. Below is the sequence of regression analyses.

1. A regression equation will be tested in which visual-spatial skills will be used to predict internalizing problems.
2. Following detection of a significant regression coefficient, visual-spatial skills will be used as the predictor variable for social perception.
3. Following detection of a significant regression coefficient, visual-spatial skills and social perception will be used to predict internalizing problems. Full mediation of social perception will be supported following a change from statistical significance to non-significance in the magnitude of the regression coefficient for visual-spatial skills. Partial mediation will be signified by a simple decrease in the magnitude of the visual-spatial skills coefficient.
4. Indirect effects of visual-spatial skills on internalizing problems through social perception will be tested using a procedure developed by Sobel (1982).

5. A regression equation will be tested with visual-spatial skills and social perception as predictor variables for social skills. Significant correlation coefficients are expected for each predictor.
6. Finally, a regression equation will be tested with visual-spatial skills, social perception and social skills as predictor variables for internalizing problems. If the regression coefficient for visual-spatial skills decreases in magnitude, social perception and social skills will be supported as partial mediators of internalizing problems. However, if the regression coefficient changes so it is no longer significantly different from zero, the two variables serve as full mediators for the relationship between visual-spatial skills and internalizing problems.

CHAPTER III: METHOD

Chapter three includes information about the individuals who participated in the study, the procedures used for collecting data, and a description of all of the measures used in the study.

Procedure

This study was conducted as part of a larger project at the University of Texas, led by Margaret Semrud-Clikeman, Ph.D., that examines social competence and developmental disorders in children and adolescents. Participants were referred by teachers, parents, or other professional sources in Austin. This study was conducted under approval from the University of Texas Institutional Review Board (IRB). Appendix B presents the IRB form. The referral source mailed interest forms and a brief study description to the parents of potential participants. Research assistants contacted parents who returned the interest forms. If the parent agreed to participate in the study the parent interview was conducted, the Structured Interview for Diagnostic Assessment of Children for DSM-IV (SIDAC) was administered, and the assessment with the child was scheduled to take place either at the University or at the child's school. A parent consent letter and a participant assent form was mailed for signatures.

Graduate research assistants in the School Psychology Program, trained in individual assessment, administered the battery of tests to each participant individually. The testing was conducted at the University of Texas or at the child's school. The testing lasted approximately 5 hours, including breaks, and took place across one or two sessions. If a participant had been administered the same intelligence, achievement, or neuropsychological measures as those used in this study within the past 3 years, those

tests were not be re-administered if results were made available. Children and parents were informed that participation in the study was voluntary and that the participant could choose to withdraw at any time without repercussions.

Participants

RECRUITMENT

As part of an ongoing study a the University of Texas at Austin, students were recruited through referrals made by outside agencies, including parents, schools, pediatricians, and clinics, due to diagnosed or suspected NVLD, Asperger's Syndrome, VLD, or ADHD: PI. Individuals participated on a voluntary basis. Participation consisted of completing a free neuropsychological screening. The battery of tests consisted of measures of: cognitive ability, academic achievement, social/emotional functioning, and behavior. After testing was complete, parents of participating children received a brief summary report describing the test results and their child's strengths and weaknesses in these various domains. Group criteria are described below.

GROUP CRITERIA

All participants were between ages 8 and 14 years of age. All children in this study were required to have a Full Scale IQ score of 85 or above on the Wechsler Intelligence Scale for Children – III (WISC-III; Wechsler, 1991), WISC-IV (Wechsler, 2003) or the Wechsler Abbreviated Scale of Intelligence (WASI; The Psychological Corporation, 1999). None of the participants had a history of head injury, seizures, psychotic symptoms, mental retardation or multiple learning disabilities. All participants spoke English as their primary language. In addition, all participants had normal hearing and vision and regular school attendance. Participants who met criterion for one of the

three diagnostic groups were included in the sample. Table 2 includes demographic variables of each group.

Table 2: Frequencies of Demographic Characteristics for the Sample by Group and Total

Variable	*NVLD/AS with ADHD: PI*	*VLD with ADHD: PI*	*ADHD: PI*	*Total*
Age				
8	4	3	4	11
9	1	6	6	13
10	5	3	9	17
11	4	3	5	12
12	2	2	4	8
13	3	1	2	6
14	1	2	1	4
Total	20	20	31	71
Gender				
Male	14	11	23	48
Female	6	9	8	23
Total	20	20	31	71
Ethnicity				
Caucasian	17	17	26	60
Hispanic	2	2	4	8
African-American	1	0	0	1
Asian	0	0	1	1

Bi-racial	0	1	0	1
Total	20	20	31	71

NVLD/AS with ADHD: PI Group

The following items were used as inclusion criterion for individuals with a suspected NVLD classification. These criterion have been found to be the most indicative features of the syndrome (Harnadek & Rourke, 1994). NVLD status was based on meeting two out of the first three criterion and the fourth criterion.

1. Impaired performance in mathematics as measured by a score on the Wechsler Individual Achievement Test-II Math Reasoning subtest (Wechsler, 2002) that is at least 16 points below the individual's Full Scale IQ on the WISC-III, WISC-IV, or WASI.
2. Visual-spatial deficits as measured by a Benton Judgment of Line Orientation (JLO; Benton, Varney & Hamsher, 1978) score that is at least one standard deviation below the mean
3. Bilateral motor skills deficits as measured by a Purdue Pegboard, Grooved Pegboard, or Finger Tapping Test that is one standard deviation below the mean.
4. ADHD: PI diagnosis

Participants with professional diagnoses of NVLD or AS were also included in this diagnostic group.

VLD with ADHD: PI Group

The VLD Group diagnostic criteria was based on a 16-point discrepancy rule used in the state of Texas. Achievement scores must be below average (standard score of 90). However, if an individual obtained a FSIQ greater than 120 and a 16-point discrepancy

exists, two professionals in school psychology used their clinical judgment and were in full agreement to determine group eligibility.

1. A 16-point discrepancy between FSIQ and WIAT Word Reading score that is <90.
2. A 16-point discrepancy between FSIQ and WIAT Reading Comprehension score that is <90.
3. ADHD: PI diagnosis

Participants with professional diagnoses of dyslexia were also included in this diagnostic group.

ADHD: PI Group

Individuals in this group met DSM-IV (American Psychiatric Association, 2000) criteria for ADHD: PI as measured by parental endorsement of at least six of the inattentive items and less than six of the hyperactivity or impulsivity items on the SIDAC. See Appendix C for the specific DSM-IV criteria. Participants with professional diagnoses of ADHD: PI were also included in this diagnostic group.

SAMPLE SIZE

A total of 71 participants were selected to be a part of the current study. Twenty participants qualified for the NVLD/AS group; 20 participants qualified for the VLD group; and 31 participants qualified for the ADHD: PI group. Originally, 22 participants per group were deemed necessary to obtain a probability of greater than .80 to detect an effect size of d = .68 at an alpha level of .05. This effect size was based on prior research (Landau et al., 1999). The pre-established quota for each group was not entirely fulfilled due to limited recruitment possibilities. All participants had an ADHD: PI diagnosis so as to control for the confounding effects of attention on the dependent variables.

Instrumentation

INDEPENDENT MEASURES

The following measures were used as part of the neuropsychological screening that each of the participants completed. For individuals who did not have a previous diagnosis, the following measures were used to determine group eligibility.

Wechsler Intelligence Scale for Children – Third Edition (WISC-III; Wechsler, 1991).

This individually administered intelligence test provides a comprehensive measure of general cognitive functioning for children ages 6-16. The Full Scale IQ score represents an individual's general cognitive capacity when there is not a significant difference between the other two broad scores (Verbal IQ and Performance IQ). The Verbal IQ is representative of verbal comprehension abilities and the Performance IQ score is representative of perceptual organization. Because it is the subtest with the highest correlation with the VIQ (r = .78), the Vocabulary subtest will be administered and will provide an estimate of VIQ (Wechsler, 1991). Similarly, Wechsler (1991) reports that the Block Design subtest has the highest correlation with the PIQ (r = .65). Therefore, this subtest will be administered to provide an estimate of PIQ. These subtests yield scaled scores that have a mean of 10 and a standard deviation of 3. Prorated FSIQ scores will be obtained based on calculations from these scaled scores. A high correlation was found between this prorated FSIQ and actual FISQ (r = .86) (Wechsler, 1991). Thus, it is a reliable and valid method of condensing the WISC-III. The WISC-III has been shown to correlate with other intelligence tests including the Differential Ability Scales (DAS; Elliott, 1990). The FSIQ was found to correlate with the General Conceptual Ability score of the DAS at .92 (Elliott, 1990).

Wechsler Intelligence Scale for Children – Fourth Edition (WISC-IV, Wechsler, 2003).

The newest revision of the Wechsler's intelligence tests has the same purpose as the WISC-III—to provide an estimate of a child or adolescent's cognitive capacity. The WISC-IV will be used for the same research purposes as the WISC-III and the WASI—that is, to ensure that an individual's intelligence is not in the mental retardation range and therefore may be included in one of the three participating diagnostic research groups. Like the WISC-III, FSIQ reliability estimates are impressive with internal consistency coefficients ranging from .96-.97 and test-retest reliability coefficients at .91 or above for each age group (Wechsler, 2003). The WISC-IV and WISC-III were found to be highly correlated (r = .89) with an average FSIQ decrease of 2.5 points (Wechsler, 2003).

Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999).

This individually administered test provides a measure of intelligence using a shorter version of other Wechsler tests. It yields Full Scale IQ which estimates general intelligence. In addition, it provides estimates of Verbal (VIQ) and Performance (PIQ) intelligence. For children ages 6-16, the FSIQ score was shown to have adequate split-half reliability (.92-.97) and adequate test-retest reliability with coefficients ranging from .85-.93 (Wechsler, 1999) In addition, adequate validity was reported as the WASI-FSIQ was found to be highly correlated with the WISC-III FSIQ with estimates ranging from .76 to .87 (Wechsler, 1999).

Wechsler Individual Achievement Test, Second Edition (WIAT-2, The Psychological Corporation, 2001).

This individually administered test provides a comprehensive measure of academic achievement. Three subtests will be used for this study: 1) Word Reading

assesses pre-reading and decoding skills, 2) Reading Comprehension assesses understanding of printed material, 3) Math Reasoning assesses understating of math concepts. Reliability estimates for each of these subtests is high with split-half correlations reported at .9 or higher. The WIAT manual (The Psychological Corporation, 2001) reports reliability estimates as follows: Word Reading (r = .97), Reading Comprehension (r = .95), and Math Reasoning (r = .92). Significant correlations are reported between these WIAT subtests and subtests from other achievement tests (The Psychological Corporation, 2001). The correlation between Word Reading and Wide Range Achievement Reading is .73. The Numerical Operations and Math Reasoning subtests were found to both correlate with the WRAT Arithmetic (r = .77 and r = .67, respectively) (The Psychological Corporation, 2001).

Structured Interview for Diagnostic Assessment of Children for DSM-IV (SIDAC).

The ADHD portion of this structured interview will be administered by a trained graduate student to each participant's primary caregiver. The questions are aligned with the DSM-IV (American Psychiatric Association, 2000) criteria for ADHD diagnosis. Based on the frequency of the informant's endorsements, the interview can yield an ADHD diagnosis differentiated by type (i.e., Predominately Inattentive, Hyperactivity/Impulsive, or Combined). Appendix C includes the ADHD criteria from the DSM-IV (APA, 2000).

Purdue Pegboard (Tiffen, 1968).

The Purdue Pegboard is an individually administered and timed measure of manual dexterity. It yields 3 scores: a total time for dominant hand, non-dominant hand and both hands. It requires the individual to place cylindrical pegs into holes on a pegboard. There are three trials in which the individual uses his/her dominant hand first,

non-dominant hand second, and then both hands together. Test-retest correlations for 1-trial administration have been found to range from .60 to .76 with a median of .68. The manual reports validity studies on small samples making validity data for this measure insufficient (Tiffen, 1968).

Grooved Pegboard Test (GPT; Lafayette Instrument, 1989)

The Grooved Pegboard Test is an individually administered measure of finger dexterity and fine-motor coordination. It requires the individual to rapidly manipulate and place 25 ridged pegs into a metal board containing slotted holes. It yields scores for dominant and non-dominant hands. Knights and Moule (1968) showed adequate test-retest reliability of children aged 8-15 with the dominant hand reliability coefficient at .80 and the non-dominant hand at .81. Validity studies have indicated that the GPT adequately discriminated normal children from those with neurological dysfunction (Trites, 1989).

DEPENDENT MEASURES

Judgment of Line Orientation (JLO; Benton, Varney, & Hamsher, 1978).

The JLO is an individually administered test of visual-spatial abilities. This non-timed test requires the individual to match the position and orientation of paired line segments to full-length lines. The authors of this test provide minimal reliability and validity data. A study by Lindgren and Benton (1980) demonstrated split-half reliability for a sample of children ages 7-14 ($r = .84$). Construct validity was supported by a moderate correlation between the JLO and the Beery VMI ($r = .52$). Additionally, moderate correlations were found (.33-.41) between the JLO and WISC-R Performance subtests (Riccio & Hynd, 1992). Evidence of criterion-related validity was indicated by a moderate correlation between the JLO and the Math subtetst of the WRAT-R (Riccio &

Hynd, 1992). Evidence of discriminant validity was found in a study that yielded a low correlation between the JLO and WISC-R VIQ (r = .15). This demonstrates that different constructs are being measured. Validity of the JLO has also been indicated in a study involving patients with unilateral brain disease. As expected, individuals with right-hemisphere lesions were more deficient on the JLO than individuals with left-hemisphere lesions (Eslinger & Benton, 1983).

The JLO was used in this study as one possible selection criterion and as one of the dependent variables. In previous studies by Rourke and colleagues the visual-spatial deficits in their sample of NVLD children were noted by tests that had confounding factors of visual memory and visual-motor functioning. The JLO is a purer test of visual-spatial functioning as performance on it does not depend on memory or motor skills.

Child and Adolescent Social Perception Measure (CASP; Magill-Evans, Koning, Cameron-Sadave, & Manyk, 1995).

This test is a measure of nonverbal social perception. The individual views 10 short, videotaped vignettes of social situations. The verbal content of the vignettes is inaudible requiring the individual to rely on nonverbal cues to determine emotional content depicted in the scenes. The score yields two scores: Emotion and Nonverbal Cues. Test-retest reliability coefficients were found to be .83 for the Emotion Score and .87 for the Cues Score (Magill-Evans et al., 1995). Additionally, the authors assessed inter-rater reliability with a correlation between testers for both Emotion and Cues scores at r = .95. The Emotion Scores and Cues Scores significantly correlated with age (r = .82 and .73 respectively) indicating that test performance is a function of development. The authors indicated that scores on the CASP do not significantly depend on expressive vocabulary skills as demonstrated by a non-significant correlation between the Expressive One Word picture Vocabulary Test-Revised (Gardner, 1990) and the Emotion

Score and Cues Score (r = .11 and r = .07 respectively). The authors contend that the CASP measures a construct that taps more than just the child's vocabulary related to social perception. For the normative sample, the Emotion Scores and Cues Scores were found to be highly correlated (r = .88); however, for a sample of children with known social perception deficits (i.e., Asperger's Syndrome and Autism Spectrum Disorder) the correlation between these two scores was found to be insignificant (r = .35). This validity study showed that most children in this sample had Emotions scores that were 1.5 standard deviations below the mean and Cues scores that were 3 standard deviations below the mean. Both of the scores will be used to assess social perception deficits in this study.

Behavior Assessment System for Children (BASC; Reynolds & Kamphaus, 1992). Social Skills and Internalizing Composite.

In questionnaire format, the BASC is designed to assess children's and adolescents' emotional disorders, personality constructs, and behavior problems. Items are scored on a 4-point scale and yield clinical scaled scores as well as composite scores. This study will use the Internalizing Problems Composite score and the Social Skills score from the Parent Rating Scales. Scores are reported with a mean of 50 and a standard deviation of 10. Reliability studies on the PRS indicate that the Social Skills is one of the most reliable scales for children ages 6-18 with coefficient alphas ranging from .86-.89 and test-retest reliabilities ranging from .74-.88 (Reynolds & Kamphaus, 1992). Comparable coefficient alphas were reported in the BASC-2 manual (.84-.88) (Reynolds & Kamphaus, 2004). The Internalizing Problems Composite also was shown to have high levels of reliability with coefficient alphas reported at .87-.90 and test-retest reliability ranging from .74-.94. Comparable coefficient alphas were reported in the BASC-2 version of the test (.89-.91) (Reynolds & Kamphaus, 2004). There was a moderate level

of correlation reported between the BASC Social Skills scale and the Child Behavior Checklist Social Problems scale (r = .33-.58). The Internalizing Problems Composite of the BASC-2 was shown to have a moderate correlation to the ASEBA Child Behavior Checklist (r = .69) (Reynolds & Kamphaus, 1992). A high level of correlation was found between the Internalized Problems Composite and the CBCL Internalizing composite (r = .67-.74). A moderate correlation was found between the Internalized Problems Composite and the Conner's Parent Rating Form, Anxious-Shy scale (r = .51). According to the authors of the BASC-2, correlations between the corresponding BASC and BASC-2 scales are "extremely high" with a range of .73-.90 or higher (Reynolds & Kamphaus, 2004, p. 184).

CHAPTER IV: RESULTS

All analyses were conducted using the Statistical Package for the Social Sciences (SPSS) for Windows. An alpha level of .05 was set prior to analysis. Preliminary analyses were conducted to determine if there were differences among the three diagnostic groups on factors including gender, race, age, and IQ. The results of these analyses and results of each research hypotheses are presented below.

Preliminary Analyses

Two chi-square analyses were conducted to determine if there were differences among the three diagnostic groups on gender and race/ethnicity. The results of the chi square test revealed no statistically significant difference among the groups on these two variables. The results of the analysis are presented in Table 3.

Table 3: Chi-Square Analysis for Demographic Variables by Group

Variable	*Df*	*n*	χ^2	p
Gender	2	71	2.118	.347
Race/Ethnicity	2	71	6.524	.589

A one-way analysis of variance (ANOVA) was conducted to determine if there were differences among the three diagnostic groups on age. No significant differences among the means were found, F (2, 68) = .166, p = .847. A MANOVA was done to determine if there were differences among the 3 groups on Full Scale IQ, Verbal IQ, or Performance IQ. Results indicated that there were statistical differences in IQ among the groups, *Wilks'* _ (6, 126) = 4.880, p ≤ .001. As shown in Table 4, no significant differences among the means were found on the FSIQ; however, post-hoc analyses using Tukey Honestly Significant Difference test indicated that the groups differed on PIQ and

VIQ. More specifically, the VLD group had significantly lower scores than the NVLD group; and the NVLD group had significantly lower scores than the ADHD: PI group on PIQ.

Table 4: Group Means, Standard Deviations and Partial Eta-Squared Coefficients for FSIQ, VIQ, and PIQ MANOVA

	NVLD/AS with ADHD: PI	*VLD with ADHD: PI*	*ADHD: PI*	*F (df = 2, 65)*	η_p^2
FSIQ	104.350 (15.931)	102.550 (9.817)	108.536 (14.645)	1.197	.036
VIQ	112.900 $_a$ (14.545)	100.250 $_a$ (11.657)	106.286 (10.540)	5.421**	.105
PIQ	94.45 $_b$ (21.294)	105.200 (12.581)	108.0357 $_b$ (16.812)	3.825*	.143

*p <.05, **p <.01

[a b]Means sharing the same subscript differ at p < .05

Primary Analyses

HYPOTHESIS 1

It was hypothesized that there would be a difference in scores among groups on the JLO, CASP, BASC Social Skills scale, and BASC Internalizing Composite. A multivariate analysis of variance was conducted to examine the multiple parts of Hypothesis 1 and results indicated that, indeed, there were significant statistical differences among groups, *Wilks'* Λ (10, 122) = .554, $p \leq .001$. Means and standard deviations are reported in Table 5. Twenty-six percent of the multivariate variance was associated with diagnostic group membership as shown by the η_p^2 of .256. Also, observed power was 99.8% which suggests a high likelihood of detecting differences among the groups. Follow-up univariate ANOVAs were conducted and indicated that scores on the

JLO, (F (2, 65) = 3.782, p = .028), CASP-Emotion (F (2, 65) = 7.777, p = .001, BASC Social Skills (F (2, 65) = 7.505, p = .001), and BASC Internalizing Composite (F (2, 65) = 3.455, p = .037) were all significantly related to diagnostic group. CASP-Nonverbal scores, however, were not significantly related to diagnostic group (F (2, 65) = 2.729, p = .073). Post-hoc tests using Tukey HSD group comparisons were conducted to assess differences among the groups on the JLO, CASP-Emotion, BASC Social Skills and BASC Internalizing Composite. The NVLD/AS group significantly differed from the ADHD: PI group on JLO performance (p = .021), CASP-Emotion (p = .003), and BASC-Parent Internalizing Composite scores (p = .029). The NVLD/AS group significantly differed from the VLD group on the CASP-Emotion scores (p = .003) and BASC-Social Skills score (p = .001).

Table 5: Group Means, Standard Deviations and Partial Eta-Squared Coefficients for JLO, CASP, BASC Social Skills, and BASC Internalizing Composite

	NVLD/AS with ADHD: PI	*VLD with ADHD: PI*	*ADHD: PI*	*F (df = 2, 65)*	η_p^2
JLO	-1.264_{a} (1.908)	-.552 (1.214)	$-.163_{a}$ (1.067)	3.782*	.104
CASP-Emotion	$-1.463_{a\,b}$ (1.007)	$-.250_{a}$ (.992)	$-.387_{b}$ (1.160)	7.777**	.077
CASP-Nonverbal Cues	-1.862 (1.461)	-.985 (1.240)	-1.516 (.811)	2.729	.193
BASC- Social Skills	38.300_{a} (8.676)	50.00_{a} (7.762)	44.61 (10.194)	7.505**	.188
BASC-Internalizing Composite	59.90_{a} (13.954)	54.294 (9.570)	51.871_{a} (8.698)	3.455*	.096

*p <.05, **p <.01

[a b]Means sharing the same subscript differ at p < .05

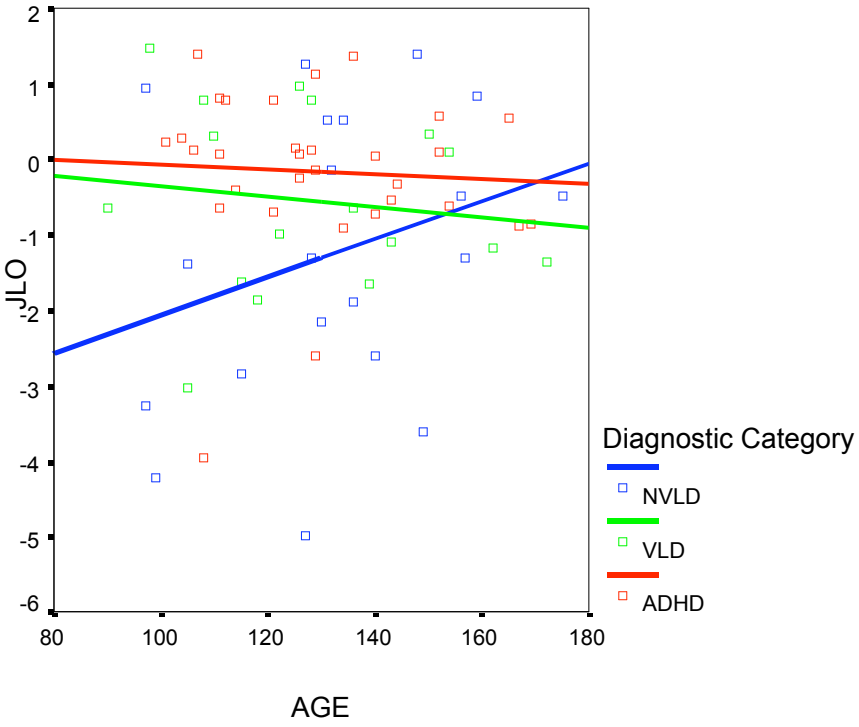
HYPOTHESIS 2

It was hypothesized that the effect of age on JLO scores would depend upon diagnostic group. Multiple regression analysis was used to determine the effects of each of these independent variables and an interaction term on JLO scores. For the purposes of this analysis, a dummy variable was created with NVLD/AS group coded 1 and the ADHD: PI and VLD groups both coded 0. An additional preliminary procedure for this analysis was the centering of the age variable as a way to reduce multicollinearity (Keith, 2006).

JLO scores were then regressed on the two independent variables (centered age and diagnostic group) in a simultaneous multiple regression. Together these variables accounted for 9.7% of the variance in JLO performance which was statistically significant, R^2 = .097, F (2, 65) = 3.504, p = .036. Only diagnostic group, however, contributed significantly to the prediction of JLO scores, _ = -.309, b = -.979, t(-2.616), p = .011. The unstandardized regression coefficient, b = -.979, indicates that the NVLD/AS group scored, on average, 1 standard z-score lower on the JLO as compared to VLD and ADHD: PI children. Age alone was not a significant predictor variable for JLO scores, _ = .069, b = .005, t(.587), p = .559.

Next, a cross-product term for age by diagnostic group was added to the regression equation to examine the possible interaction effect of these two variables. Analyses indicated that the interaction was not statistically significant, ΔR^2 = .038, F (1, 64) = 2.836, p = .097. As shown in Figure 1 by the regression line for each of the 3 groups, there was a nonsignificant trend for the NVLD/AS group to have gradually improving JLO score with age.

Figure 1: Scatter Plot with Regression Lines Predicting JLO Scores



HYPOTHESIS 3

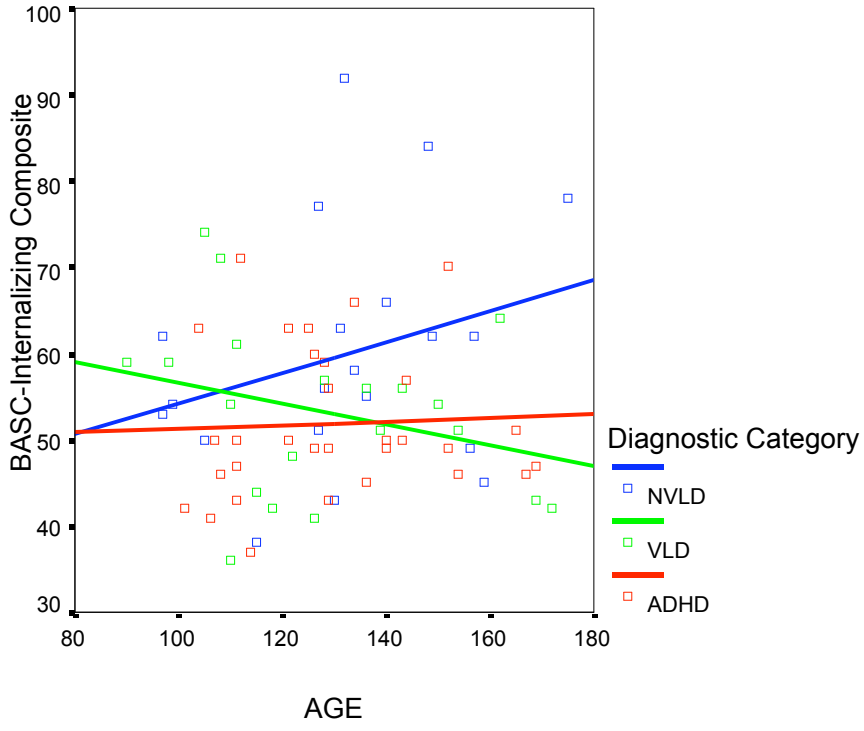
It was hypothesized that the effect of age on BASC Internalizing Composite scores would depend upon diagnostic group. Multiple regression analysis was used to determine the effects of each of these independent variables and an interaction term on BASC Internalizing scores. Similar to the previous regression analysis, a dummy variable was created with NVLD/AS group coded 1 and the ADHD: PI and VLD groups coded 0. Age was also centered.

BASC Internalizing Composite scores were then regressed on the two independent variables (centered age and diagnostic group) in a simultaneous multiple regression. Together these variables accounted for 9.4% of the variance on Internalizing Composite score which was statistically significant, $R^2 = .094$, F (2, 68) = 3.527, p = .035. Only diagnostic group, however, contributed significantly to the prediction of

Internalizing Composite scores, _ = .303, *b* = 7.478, *t*(2.619), *p* = .011. The unstandardized regression coefficient, *b* = 7.478, indicates that the NVLD/AS group scored, on average, 7 points higher on the Internalizing Composite as compared to VLD and ADHD: PI children. Age was not a significant predictor variable for Internalizing Composite scores, _ = .031, *b* = .016, *t*(.266), *p* = .791.

Next, a cross-product term for age by diagnostic group was added to the regression equation to examine the possible interaction effect of these two variables on Internalizing Composite scores. Analyses indicated that the interaction was not significant, ΔR^2 = .039, *F* (1, 67) = 2.991, *p* = .088. The regression line, shown in Figure 2, suggests a non-significant trend for the NVLD/AS group to have gradually higher BASC Internalizing Composite Scores as they get older, indicating greater dysfunction in this area.

Figure 2: Scatter Plot with Regression Lines Predicting BASC-Internalizing Composite Scores



HYPOTHESIS 4.

Hypothesis 4 stated that the relation between visual-spatial functioning and internalizing socioemotional functioning would be partially mediated by social perception and social skills. First, the predictor, criterion, and mediator variables were intercorrelated. Table 6 shows the results of these bivariate correlations. The JLO was not significantly correlated with any of the other 3 measures.

Table 6: Intercorrelations for JLO, CASP, BASC-Social, and BASC-Internal

Variable	*JLO*	*CASP-Nonverbal*	*CASP-Emotion*	*BASC-Social*	*BASC-Internal*
JLO	1.0	.130	.101	-.089	.007
CASP-Nonverbal		1.0	.591**	.322**	-.246*
CASP-Emotion			1.0	.403**	-.202

BASC-Social	1.0	-.272*
BASC-Internal		1.0

*$p < .05$. **$p < .01$.

A series of regression analyses were conducted to test for mediation. The results are presented in Table 7. First, the BASC-Internalizing Composite scores were regressed onto JLO scores. Results indicated that performance on the JLO did not significantly predict Internalizing Composite scores, _ = .007, b = .050, t(.053), p = .958. Next, CASP-Emotion scores were regressed onto JLO scores and the result was not significant, _ = .101, t(.821), p = .415. Next Internalizing Composite scores were regressed onto CASP-Emotion and JLO scores. The CASP-Emotion and JLO did not significantly predict Internalizing Composite scores, R^2 = .039, F (2, 65) = 1.304, p = .279. These same two variables, however, significantly predicted Social Skills scores, R^2 = .205, F (2, 65) = 8.395, p = .001. The CASP-Emotion and JLO accounted for 20.5% of the variance in Social Skills; however, of these two predictor variables, only the CASP-Emotion significantly predicted Social Skills, _ = .446, t(4.017), $p \leq .001$. The final regression equation regressed Internalizing Composite on JLO, CASP-Emotion, and Social Skills. These results were not significant. R^2 = .087, F (3, 64) = 2.041, p = .117.

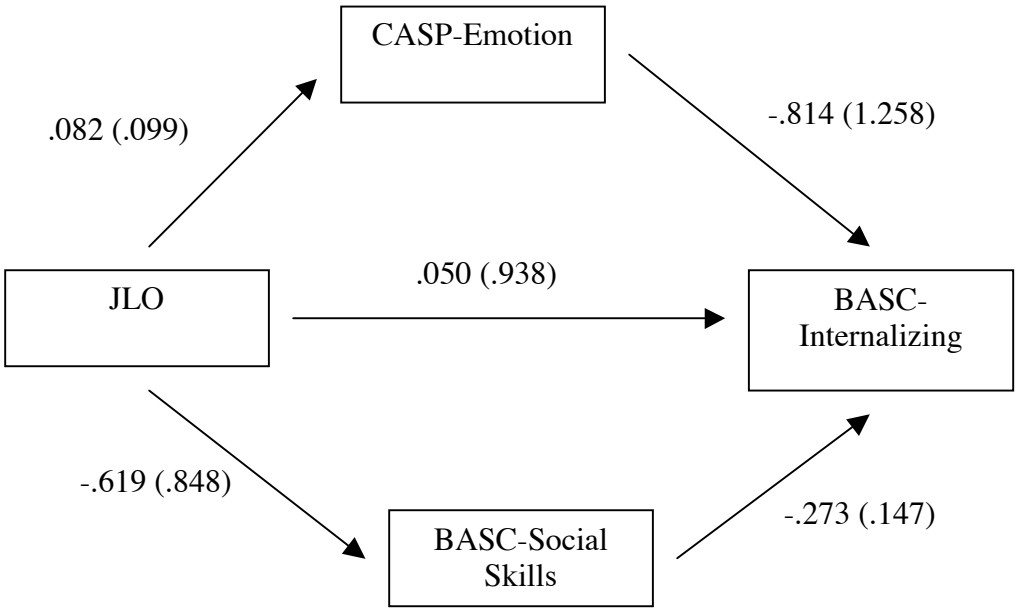
Table 7: Regression Analyses Table.

Predictor Variable	Criterion Variable	b	Std. Error	□	t	p
JLO	BASC-Internal	.050	.938	.007	.053	.958
JLO	CASP-Emot	.082	.099	.101	.821	.415
CASP-Emot	BASC-Internal	-.814	1.258	-.087	-.647	.520
JLO	Social Skills	-.619	.848	-.089	-.729	.469
CASP-Emot	Social Skills	3.804	.947	.446	4.017	≤.001

Social Skills	BASC-Internal	-.273	.147	-.248	-1.849	.069

The Sobel test of mediation was conducted to calculate indirect effects among the hypothesized predictor, outcome, and mediator variables. Preacher and Leonardelli's (2001) interactive calculation tool was used to calculate these indirect effects for the mediation model (www.unc.edu/~preacher/sobel/sobel.htm). Because there were two hypothesized mediator variables, two separate mediational analyses were analyzed. Results of the first mediational analysis indicated that the effect of JLO scores on BASC-Internalizing Composite scores was not mediated by CASP-Emotion scores, Sobel test statistic = -.510, p = .610. The second mediational analysis, with BASC-Social Skills as the mediator of the effect of JLO on BASC-Internalizing Composite, was also not significant, Sobel test statistic = -.680, p = .500. Figure 3 displays results from both mediation analyses with regression coefficients used for calculations in the Sobel test.

Figure 3: Mediation Model with Unstandardized Regression Coefficients and Standard Error in Parentheses.


CASP-Emotion
.082 (.099)
-.814 (1.258)
JLO
.050 (.938)
BASC-
Internalizing
-.619 (.848)
BASC-Social
Skills
-.273 (.147)

CHAPTER V: DISCUSSION

Summary of Findings

It has been well-documented that visual-spatial deficits are common among children with NVLD (Harnadek & Rourke, 1994, Rourke, 1989); however, its role in the social dysfunction aspects of the disorder is unknown. One of the primary tenets of Rourke's (1989) NVLD theory is that social deficits are a consequence of the underlying neuropsychological profile which includes visual-spatial deficits. The underlying assumption is that visual-spatial deficits implicate impairments in the nonverbal, visual-spatial aspects of social interactions (e.g., facial expression, hand gestures, prosody, personal space). This proposed causal relationship between visual-spatial skills and social functioning has been explored by others (e.g. Dir, 1999; Forrest, 2004; Petti et al., 2003; Semrud-Clikeman & Hynd, 1990). Results of these previous studies, however, have yielded mixed conclusions, thus warranting the exploration pursued by the current study.

The primary focus of this study was to provide some insight into the neuropsychological underpinnings of social and emotional problems that plague children with NVLD. It was hypothesized that visual-spatial deficits, one of the major neuropsychological deficits of this group of children, would partially explain the socioemotional problems by which they are characterized. The four constructs investigated were visual-spatial functioning, social perception skills, social skills, and internalizing socioemotional functioning. It was hypothesized that individuals with NVLD/AS would be significantly more deficient in all of these areas as compared to the ADHD: PI group, VLD group, or both. Furthermore, it was hypothesized that NVLD/AS children would show poorer skills with age, as Casey, Rourke, & Picard, (1991)

suggested. In addition to a statistically significant link between visual-spatial skills and socioemotional functioning, it was hypothesized that this relationship would be mediated by social perception skills and social skills, as previous research has indicated positive correlations among these variables.

In summary, the NVLD/AS group, as expected, showed impairments in all areas (i.e., visual-spatial skills, social perception, social skills, and internalized socioemotional functioning) and significantly differed from one or both of the other groups on each of the four domains. Support was not found for the age effects for the NVLD/AS group. That is, visual-spatial and internalized socioemotional scores did not worsen with increasing age as expected. Also, visual-spatial skills were not significantly related to internalizing socioemotional functioning, and the hypothesized mediation variables were not statistically significant. A detailed discussion of the results follows.

VISUAL-SPATIAL SKILLS

Individuals in the NVLD/AS group scored, on average, one standard deviation below the mean on the JLO, a measure of visual-spatial perception. These scores significantly differed from the ADHD: PI group but did not significantly differ from the VLD group. These findings lend support for Rourke's (1989) theory that children with NVLD are characterized by visual-spatial deficits. Previous studies by Rourke have shown that these individuals perform poorly on tasks that require visual-spatial organization with visual memory or visual-motor integration components. Results of this study show significant deficits on the JLO which measures only visual-spatial perception and validates the claim that it is visual-spatial deficits that are at the heart of their difficulties in this area.

Also investigated in this study were the interaction effects of age and diagnostic group on visual-spatial scores. It was hypothesized that visual-spatial scores would

significantly worsen for the NVLD/AS group. Unexpected results were found in the analysis of JLO scores. No interaction was found; therefore age was not significantly related to scores for the NVLD/AS group as hypothesized. Instead, the scores presented the opposite (non-significant) trend of JLO scores that actually improved with age for children with NVLD/AS. These results contrast the findings of the cross-sectional design conducted by Casey, Rourke, & Picard (1991) that showed a decline in visual-spatial abilities as children get older. One possible explanation for not finding a similar age effect in this study is related to the type of population from which each of these studies was drawn. Casey, Rourke, and Picard (1991) used clinic-referred populations who often present with more severe symptoms than the individuals who come from public educational institutions, as was the case in this study. Also, academic intervention could be a confounding factor in addressing this research question. It is possible that older children's scores on the JLO reflect the academic support they have received to address these deficits. A useful addition to the study may have been to take into consideration the amount and type of intervention each of the participants had received in their education.

SOCIAL PERCEPTION

Children with NVLD/AS also showed significant problems with social perception, thus supporting Rourke's (1989) theory. More specifically, they showed deficits in detecting the emotions being conveyed in a social situation. Statistical significance among diagnostic group means, however, was not found on the second measure of social perception -- CASP-Nonverbal Cues scores. While NVLD/AS scores were nearly two standard deviations below the age-level norms, their scores did not significantly differ from the other groups' below-average norms. Thus, it appears that children with NVLD/AS have significant problems understanding nonverbal aspects of social interaction which affects their ability to "read" emotions being conveyed. This

finding is consistent with previous research conducted (Petti et al., 2003) that found NVLD children having significant social perception differences from VLD and non-disabled children. The current study also sheds light on previous studies (e.g., Hall, Peterson, Webster, Bolen, & Brown, M.B., 1999; Sprouse, Hall, Webster, & Bolen, 1998) that have found significant differences between heterogeneous LD groups and control groups on a measure of facial expression interpretation. This study supports the notion that not all children with LD are socially impaired. Instead it is the subtype, NVLD, that is more impaired on social perception tasks than children with language-based disorders.

As previously mentioned, the NVLD/AS group significantly differed from each of the other two groups on the CASP-Emotion index. Unexpectedly, this same pattern was not found on the CASP-Nonverbal Cues index even though both indexes are purported to measure the same construct and are intercorrelated (Magill-Evans et al., 1995). In this study, all diagnostic groups showed significant impairments on Nonverbal Cues index and were not statistically different from each other. There are several areas of discussion and possible explanations for the discrepancy between significant group differences found on the Emotion Index and non-significant group differences found on the Nonverbal Cues Index.

First, it is necessary to review the differences between the two composite scores that the CASP yields. Both the Nonverbal Cues and Emotion composite scores were used as social perception outcome variables in this study to provide more information about the profiles of individuals in the 3 diagnostic groups. Although the 2 scores are purported to measure social perception, it appears that the 2 different tasks which compose these composites tap into varying degrees of social perception. In comparison to the Emotion scores, the Nonverbal Cues component is a lower order task that measures static

identification of a specific set of nonverbal cues demonstrated in the scene. Identifying emotions, as measured by the Emotion score, is a higher order task that requires more sophisticated integration of information from a variety of sources simultaneously. Both are social perception measures, by construct definition; however, the 2 tasks require different skill sets.

Second, it is important to consider the potential effects of attention on examinee CASP performance. The variable of attention was controlled for in this study by establishing the inclusion criterion that all participants qualify for ADHD: PI diagnosis; therefore explanations for outcomes cannot be based solely on attention. However, the influence of attention on CASP performance is worthy of discussion. An observation from the researcher is that the CASP can be cognitively taxing for individuals with attention problems. This is shown by the nature of the test which requires the examinee to sustain attention for approximately 30 minutes and carefully attend to all of the details of the scenes which include nonverbal acts that range in presentation from relatively overt to relatively subtle. There are 10 scenes to view and a period of questioning after each. For individuals with attention problems, the monotony of the inquiry can cause their attention to waver, especially toward the end of the test. All groups demonstrated significantly below average performance on the Nonverbal Cues composite score. It is possible, then, that since all participants were identified with inattentive symptoms that this composite is highly sensitive to attentional processes. Moreover, it is possible that the Emotion score is less influenced by attentional processes and more influenced by an individual's ability to integrate various modalities of information (nonverbal and contextual) to make a meaningful assumption of emotions being portrayed.

Thus, in combining the two previous points (i.e., composite scores measure different skill sets of social perception and attention influences scores), the Emotion score

justifiably was more successful at differentiating social perception of individuals among the three groups. Individuals in the NVLD/AS group have deficits in nonverbal cues identification and multi-modal integration, thus making the complex interpretation more difficult for these individuals as compared to their VLD and ADHD: PI counterparts. This pattern of performance is related to Rourke's (1989) theory that suggests NVLD children have difficulty with integrating multiple modes of information. Although the ADHD: PI and VLD children had difficulty identifying the nonverbal cues in the social situation, they appeared to be more successful at integrating the cues, (e.g., contextual and nonverbal) to accurately identify emotions. In contrast, children in the NVLD/AS group were not able to integrate this information nor make inferences from the environmental and contextual cues in order to interpret emotions. Thus it appears that the Emotion score is a more valid measure of social perception as it requires simple identification of cues and integration of these cues. Furthermore, it was the score that successfully differentiated the NVLD/AS group, the group with hypothesized social perception deficits, from the other two groups. Thus, it is the combination of attention problems with the true social perception problems of NVLD/AS individuals that together make complex interpretation of emotions so difficult. As stated in previous literature, very young children with NVLD/AS have impairments in processing nonverbal information and associating this information with internal feelings (Rothenberg, 1998). As they get older, they have tremendous difficulty understanding the emotional stimulation present in clinical and real-world settings as shown by these results.

Another explanation for non-significant findings between groups on the Nonverbal Cues measures is related to the validity of these scores. It is evident from their Emotion scores in the average range that individuals in the VLD and ADHD: PI groups successfully completed the higher order task of integrating nonverbal cues in the scene to

accurately identify emotion. Given success in the higher order task, it would be assumed that similar levels of success would be achieved in the lower-order tasks. Results of this study were in direct contrast. Individuals in the VLD and ADHD: PI group did not respond to the examiners inquiry requests about nonverbal cues at a level that was commensurate with their overall understanding of emotions. It is likely that they were aware of such cues, but simply did not report their detailed knowledge in response to the open-ended questions of the examiner. Therefore, the Nonverbal Cues scores may not be a good estimate of their true ability to identify such cues.

In summary, multi-modal integration, attention, and validity of the outcome variables are explanatory factors of the discrepant results of the two social perception analyses. This pattern of performance, although unexpected, offers some insight into future uses of this measure, as it appears that only one of the composite scores is a valid measure of the complex construct of social perception. In addition, it provides useful information regarding the nature of intervention that would be appropriate for children with various social problems. Each of these clinical implications will be discussed in the next section.

SOCIAL SKILLS

As expected, the NVLD/AS group showed social skills deficits in the clinically significant range and at significantly higher levels than the VLD group. This finding supports previous research that suggests that the nature of NVLD is more likely to affect social functioning as compared to children with verbal LDs (DeLuca et al., 1991; Landau et al., 1999; Petti et al., 2003; Rourke, 1989; Strang & Rourke, 1985). The NVLD/AS group did not significantly differ from the ADHD: PI group whose scores were within normal limits. Previous research has suggested impaired social skills functioning among children with ADHD (Guevremont & Dumas, 1994; Landau & Milich, 1988; Landau &

Moore, 1991); however, this literature has not differentiated the predominately inattentive subtype from the hyperactive/impulsive subtype. Based on the results of the current study, parents do not report significant social skills impairments among their children with ADHD: PI. Thus, it may be that the social skills problems, to which previously literature has referred, has represented the problems associated with the ADHD: Combined type that was not included in this study.

INTERNALIZED SOCIOEMOTIONAL FUNCTIONING

Significant differences were found among the three groups on a measure of internalizing socioemotional functioning. The NVLD/AS group had greater levels of reported internalizing problems as compared to the ADHD: PI group. The results showing a mean composite score of 60 is in the "At-Risk" range and suggests the potential for seriously maladaptive behavior including anxiety and depression. This finding supports Petti and colleagues' (2003) finding that children with NVLD are twice as likely as children with VLD to have an internalizing disorder.

Support was not found for the hypothesis of an interaction effect of age and diagnostic group on internalizing problems. This finding may have been due to small sample size; however there was a non-significant trend, in the expected direction, such that internalizing problems increased with age for children in the NVLD/AS group. This pattern is consistent with previous research that showed increasing internalized psychopathology (Casey, Rourke, & Picard, 1991; Pelletier, Ahmad, & Rourke, 2001) and greater predisposition to suicidality among older children with NVLD (Rourke, Young, & Leenaars, 1989).

MEDIATION MODEL

The final hypothesis addressed the mediating effects of the relation between visual-spatial skills and internalizing problems. Regression analyses indicated that visual-spatial skills, as measured by JLO, did not significantly predict BASC-Internalizing Composite scores. Thus, it follows logically that the two variables, social perception skills and social skills, do not mediate the hypothesized relation between visual-spatial skills and internalizing socioemotional functioning. It is evident that for the NVLD/AS group significant neuropsychological deficits and social deficits are present; however, this study did not provide support for the link between these neuropsychological deficits and social problems. Several explanations are possible.

First, it is possible that the mediation model was not significant due to the restriction of range of scores. As noted earlier, there was not a significant relationship between JLO scores and any of the social functioning measures. The value of correlation coefficients, however, may not be valid since a restricted range of both of the variables was analyzed. A non-disabled control group, which would have most likely produced average level scores on these measures, was not included in this study. Subsequently, the full range of possible scores were not included in the analysis. All three diagnostic groups had mean scores that were below age norms; therefore the range was limited to these values. Individuals with VLD had more visual-spatial problems than would be expected given neurocognitive performance patterns cited in the previous literature (Ozols & Rourke, 1985). However, the low average visual-spatial performance of the VLD group is consistent with other researchers who suggest that reading disability is the result of visual-spatial deficits in combination with phonological impairments (Eden et al., 1995). The addition of scores from a non-disabled control group may have allowed for a better regression analysis for this research question.

Another explanation is that the link between visual-spatial skills and social functioning may, indeed, not exist. Individuals with low visual-spatial performance may have fewer or greater internalizing problems as compared to those with average visual-spatial performance. As is suggested by Barton and colleagues (2004), it is possible that the visual processing and social functioning originate in the same neuroanotomical structure, however, the former may not be the cause of the latter.

Based on the results of the study, the two processes (visual and social functioning) appear to be separate functions. The link between visual-spatial processing and social functioning is not readily apparent until one considers visual-spatial aspects of socialization that are often obscured by the verbal aspects of socialization. These visual-spatial components of socialization include perceiving spatial distance from other children, interpreting nonverbal cues, or directionality. These visual-spatial processes found within a social context, appear to have little to do with the abstract nature of the visual-spatial demands of the JLO. Thus, it is unlikely that intervening at this neurocognitive level will have any impact on the child's social functioning. Instead, focusing on the specific social impairments, including the social perception deficits discussed earlier, will likely have a greater impact of socialization and emotional well-being. These implications will be elaborated in the next section.

Clinical Implications

VERBAL VERSUS NONVERBAL LEARNING DISABILITIES

One of the downfalls of previous research in the realm of learning disabilities has been the generalizations made from heterogeneous groupings of children with LD. Information on socioemotional functioning has most often relied on research that has drawn conclusions about socioemotional functioning of undifferentiated samples of LD

children. The goals of this study were to highlight such differences among two LD subtypes and to stress the importance of differentiating LD subtypes instead of making generalizations across the entire LD population. Children with VLD and NVLD present with different clinical profiles of academic and social functioning. This study is consistent with other studies that have shown the significant social impairments that are exhibited among children with NVLD. Children with NVLD/AS were distinctly different from children with VLD on measures of social perception and social skills. Although not significantly different from each other statistically, the two diagnostic groups do present clinically different socioemotional functioning profiles. In general, children with NVLD/AS were clinically "at risk" for internalizing socioemotional problems, whereas children with VLD were not. It is important to recognize that children with NVLD/AS are susceptible to internalized variety of socioemotional problems. The nature of such problems may make it difficult to recognize. It will be important for adults in these children's lives to be tuned in to feelings of sadness, loneliness and worry that these children may be experiencing.

DIAGNOSTIC CRITERIA

Formal diagnoses of NVLD are debatable as there is not a consensus as to what criteria are essential characteristics of the disorder. One of the aims of this study was to inform efforts to establish diagnostic criteria so that professionals in the field can better identify those individuals exhibiting the constellation of features. This study is consistent with other research that places visual-spatial deficits as one of the main diagnostic features of NVLD. Individuals in this study scored well below aged-level norms and were the only group to show clinical impairments. Thus, it is evident that a deficit in visual-spatial skills is a common feature of the disorder and that the JLO provides a good discriminatory measure of this skill set.

Inclusion of internalized socioemotional functioning as a diagnostic criterion is debatable. In their diagnostic impressions, some professionals require the presence of such dysfunction whereas others view it as an effect of the constellation of assets and deficits that are characteristic of the disorder. This study found that children with NVLD/AS indeed have internalized socioemotional problems at a level approaching clinical significance when compared to same-aged peers. Although their scores were significantly different from the ADHD: PI group, they were not significantly different from the VLD group. Thus, the presence of internalized socioemotional dysfunction does not appear to discriminate LD subtypes and therefore may not be an appropriate diagnostic criterion.

The other social domains measured in this study (i.e., social perception and social skills) appear to be skills that discriminate NVLD from VLD and ADHD: PI individuals. Scoring one and one half standard deviation below the mean on the social perception measure suggests significant difficulty with interpreting affect in social situations. Thus, it would seem appropriate to use a measure of social perception, like the CASP, when deciding on an NVLD diagnosis. It is important, however, to consider the confounding effects of attention on such measures that require sustained mental effort. Individuals who score poorly on the CASP may "look" NVLD due to behavioral inattentiveness. The distinction that was clarified in this study was that individuals with attention problems tend to have difficulty only with identification of nonverbal cues and not with identification of emotional expression. To the contrary, children with NVLD/AS tend to have difficulty with *both* emotion detection and reading nonverbal cues. In future research studies investigating social perception, it is recommended that the CASP Emotion score, as opposed to the CASP Nonverbal Cues score, be used as a measure of social perception, as it was the variable that measured the complexity of the construct.

INTERVENTION

The purpose of differentiating LD children is so that appropriate interventions can be implemented accordingly. The focus of this study was on the socioemotional functioning of children. While academic interventions are applicable as well, findings from this research study suggest a serious need for social intervention for children with NVLD/AS. Compared to the other diagnostic groups in this study, children with NVLD/AS showed the greatest social impairments in social perception, social skills, and internalized socioemotional functioning. These social domains, as one would expect, are intercorrelated, therefore intervening in one area is likely to influence functioning in one of the other areas. The findings from this study suggest that social interventions for children with NVLD/AS should focus on social perception deficits. They should involve hands-on, real-world practice, and skills training on reading and using nonverbal cues in social situations. In addition there should be a focus on how to integrate and fully process various modes of information from the environment in order to understand emotions being conveyed. One example of a social skills intervention program that focuses on social perception skills is the Social Competence Intervention Program (SCIP) developed at the University of Texas (Glass, Guli, & Semrud-Clikeman, 2000). The program is designed for individuals to work in peer-groups on activities related to interpreting facial expressions, body movement, vocal cues, and the integration of these nonverbal cues. The program holds different emphases for different diagnostic groups. For the ADHD: PI group, for example, the emphasis is on perspective taking, self-awareness, self-control, and varying emotional responses. For children with NVLD and AS, the emphasis is on perception and integration of cues, abstract thinking, and body awareness.

An additional implication for intervention for children with NVLD/AS group is to intervene early, hopefully at the onset of maladaptive symptoms. This study shows that

these individuals are prone to serious psychosocial problems that have the potential to get worse as they get older. The claim that these individuals are at greater risk for suicidal behavior and the increasing support from studies like this that suggest this potential should emphasize the need for parents, educators, and mental health professionals to watch carefully for the first sign of maladaptive behavior.

Limitations

Originally, a sample size of 22 individuals per group was deemed necessary to yield enough power in order to find significant findings if they exist. Due to the constraints of participant recruitment, only 20 NVLD/AS and 20 VLD met criteria for the respective group categories. There were 31 individuals who met criteria for the ADHD: PI group. It is possible that the smaller sample size decreased the power to find significant differences in some of the statistical analyses, including the regression analyses that explored interaction effects between age and diagnostic group. The greater number of ADHD: PI participants may be viewed as an over-representation of the entire sample; however, the statistical analyses conducted are robust to unequal sample size. Therefore it is not suspected that they affected the outcome.

The demographics of the sample tended to be weighted with younger children. Additionally, the age range of the sample was more limited than original expectations. The original age range for participants was set at 8-16; however, participant age only spanned to 14 years. The under-representation of older children/adolescents may partially explain the lack of significance for the regression analysis involving age as a factor.

Another potential limitation involves the inclusion of NVLD and Asperger's individuals in the same research group. While some would argue that the two disorders are virtually indistinguishable, others may argue that they differ with respect to the

presentation or severity of the symptoms they have in common. Ideally, it would be better to separate these two disorders so that differences can be documented if they exist; however, due to the difficulties in recruiting children with AS or NVLD and their low incidence, it was necessary to group them together. As a result of the inclusion of the individuals with AS, results from this study have limited generalizability to the NVLD population.

Finally, this sample was limited to individuals who exhibited attention problems that warranted an ADHD: PI diagnosis, as this was deemed the most statistically sound method of controlling for effects due to attention. The limitation of this method, however, is that results can only be generalized to VLD and NVLD/AS individuals who also show significant attention problems. Thus, it is possible that the socioemotional profiles of NVLD/AS and VLD children without co-morbid ADHD: PI would present differently than the profiles obtained in the current study.

Future Directions

This study addressed the social and emotional concerns that often characterize children with NVLD and AS. Continued research is needed in this area as there is the potential for serious maladaptive behavior among these individuals. There are several areas needing further exploration.

The first area is related to the origins of such problems. Do socioemotional problems of children with NVLD/AS stem from a neurocognitive basis? This study did not find a direct link between visual-spatial skills deficits and social problems. Would other measures of visual-spatial skills, like Wechsler Block Design, that require more hands-on spatial processing provide a better indicator of the visual-spatial problems they have in the social context?

Second, after determining whether or not there is a neurocognitive basis to such problems, the next area of exploration deserving attention is addressing the types of interventions that will affect their functioning in the social realm. Although individuals with NVLD/AS exhibit visual-spatial problems within a social context, this study did not show a significant correlation between performance on the JLO and social functioning. It is plausible that the two may be peripherally related but not directly related, and therefore not a primary area to address when designing social competence intervention. Results of this study suggest that interventions with a focus on social perception, a major deficit among these children, may be an appropriate place to begin. More research is needed on the impact that different types of intervention have on the social and emotion functioning of these children.

The current study did not find support for the hypothesis that children with NVLD would experience more socioemotional problems as they got older. However, a restricted age range and small sample size potentially affected the statistical power to find significance. Therefore, it would be useful to repeat this portion of the study with a larger sample of children with NVLD who proportionally span a wider age range.

Another area worthy of exploration is the level of awareness that these children have about their social and emotional functioning. Would BASC self-report scores reveal the impaired socioemotional functioning reported by their parent, or are these children unaware of their feelings? What follows, then, is an exploration of the types of therapeutic intervention that are best for these children. Would they benefit from a cognitive-behavioral approach to therapy where sessions are more concrete and structured, or would they benefit from an interpersonal approach to therapy where the therapist would guide them to becoming more aware of their feelings?

Finally, in studies exploring social problems in various types of disorders, researchers have commonly used terms such as "social competency disorder" (Denckla, 1983), "social developmental disorder" or "social-emotional processing disorder" (Barton, et al., 2004) to reflect the common social deficit features of children with a variety of disorders. In the first chapter, research flaws were described regarding the use of heterogeneous LD grouping. The plethora of terms for social disorders suggests that researchers are following down this same path of heterogeneous grouping. Researchers investigating children with various social competence problems should avoid the same flaws that are found in previous LD literature. While these types of groupings may satisfy research purposes, they make clinical generalizations difficult because the terms are not consistent with diagnostic codes, resulting in confusion. For research purposes, using a "social competency disorder group" may be necessary due to recruitment limitations. Individuals with such disorders are not as readily accessible as other individuals with more widely known and diagnosed disorders.

This dilemma was the struggle encountered by the current study, hence the inclusion of both NVLD and AS in order to have a reasonable sample size. It is acknowledged that this study would have been improved by the inclusion of only an NVLD diagnostic group. However, this study provided reasonable justifications for including Asperger's and NVLD in one group. That is, each of their neuropsychological profiles, including their characteristic visual-spatial deficits and impairments in nonverbal reasoning, were remarkably similar. High Functioning Autism, who are often also grouped with AS and NVLD, were specifically excluded from this diagnostic group because of documented differences in their neuropsychological profile which do not include visual-spatial deficits. Thus, the purpose of this discussion is to caution researchers pursuing studies in this area. It is important to avoid heterogeneous grouping

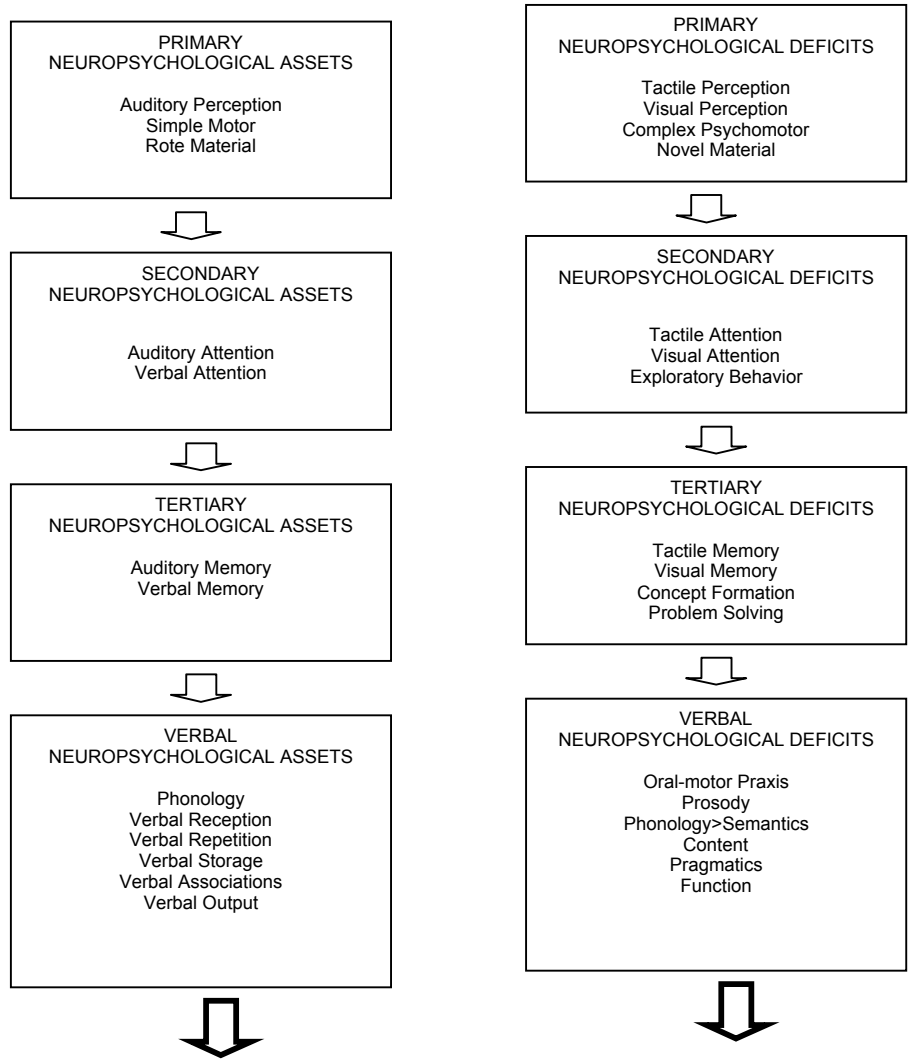
whenever possible and to aim for homogeneous grouping to provide a more robust study. However, given the limitations of recruitment, it may be wise to consider including multiple disorders in one diagnostic group as long as there is adequate justification for doing so. In addition, it is important to acknowledge limitations in generalizing the results based on the heterogeneous grouping.

More research is needed to make clinical distinctions among Asperger's Syndrome, High Functioning Autism, Autistic Disorder, Pervasive Developmental Disorders, and Nonverbal Learning Disabilities. It is evident that these disorders all have similar features, but we must determine the subtle differences that distinguish them from the others, if these differences exist. Research efforts to address this matter are greatly needed. This knowledge will not only benefit practitioners who have the job of identifying such individuals, but it will also benefit endeavors that aim to help these individuals function in normal and emotionally healthy ways in society.

In summary, the current study contributed to the understanding of individuals with two types of social competence disorders – NVLD and Asperger's Syndrome. Rourke's findings from clinic-referred samples were generalized to this school-referred sample in that the study found support for the diagnostic features commonly associated with the disorder-- visual-spatial skills deficits and social perception deficits. This study also offers some insight into the internalizing socioemotional functioning of children with NVLD. It clarifies the heterogeneity of socioemotional functioning among LD children, suggesting that it is children with the LD subtype, namely NVLD, who are at greater risk for social problems.

Appendix A

Elements and dynamics of the NVLD syndrome.



Appendix B

IRB APPROVED ON: 2/3/2006 EXPIRES ON 1/22/2007

IRB#_01 -04-22

Informed Consent to Participate in Research

The University of Texas at Austin

You are being asked to participate in a research study. This form provides you with information about the study. The Principal Investigator (the person in charge of this research) or his/her representative will also describe this study to you and answer all of your questions. Please read the information below and ask questions about anything you don't understand before deciding whether or not to take part. Your participation is entirely voluntary and you can refuse to participate without penalty or loss of benefits to which you are otherwise entitled.

Title of Research Study: Assessment of social competence in children with developmental disorders

Principal Investigator(s): Professor Margaret Semrud-Clikeman, Ph.D., Department of Educational Psychology, School Psychology Program, University of Texas at Austin. (512) 471-0274

Funding source: None

What is the purpose of this study? We are trying to learn the best ways to evaluate children suspected of having difficulties with social skill development as well as those who do not have such problems. More importantly, however, we are looking for better and more effective ways for parents and teachers to help students with social skill problems. We are asking parents of children who do not have these problems to participate in this study to determine how these children differ from children who do have social competence difficulties. We are also asking parents of children with such difficulties to participate in our study. Your child will be one of several hundred asked to participate in the project over several years.

What will be done if you take part in this research study? First, we will conduct a comprehensive assessment to determine whether your child has social skills difficulties or not. Your child will be asked to define words, solve problems, read and complete mathematics problems, complete block designs, write and draw, complete puzzles and answer questions about his/her feelings. Your child will also be asked to identify the emotions shown on computerized program. This assessment will take place in the School Psychology assessment rooms at the University of Texas or at your child's school. We will also ask you to have your child's teacher complete two rating scales that you will be provided. Parents will also be asked to complete an interview as well as behavioral rating scales and a developmental history.

What are the possible discomforts and risks? There are few known risks to this study. Your child may become fatigued from completing the tests. To avoid this difficulty, frequent breaks will be provided. Attendance in the intervention may bring up feelings that are uncomfortable. Additional support will be provided for your child and you will be fully informed about the techniques utilized as well as being provided with an outline of the activities. Treatment for serious psychological difficulties will not be provided but additional support can be found through the Austin Child Guidance Clinic at (512) 451-2242.

If you wish to discuss the information above or any other risks you may experience, you may ask questions now or call the Principal Investigator listed on the front page of this form.

What are the possible benefits to you or to others? You will receive a brief summary of the test results that may assist you in your child's school. However, this assessment is not meant to supplant comprehensive neuropsychological tests or take the place of school evaluations. Your child may benefit from the intervention but at this point in time the benefit is not established.

If you choose to take part in this study, will it cost you anything? No

Will you receive compensation for your participation in this study? No

What if you are injured because of the study? There are no known physical risks. No treatment will be provided for research related injury and no payment can be provided in the event of a medical problem.

If you do not want to take part in this study, what other options are available to you? Participation in this study is entirely voluntary. You are free to refuse to be in the study, and your refusal will not influence current or future relationships with The University of Texas at Austin.

How can you withdraw from this research study and who should I call if I have questions? If you wish to stop your participation in this research study for any reason, you should contact: Margaret Semrud-Clikeman, Ph.D. (512) 471-0274. You are free to withdraw your consent and stop participation in this research study at any time without penalty or loss of benefits for which you may be entitled. Throughout the study, the researchers will notify you of new information that may become available and that might affect your decision to remain in the study. In addition, if you have questions about your rights as a research participant, **please contact Lisa Leiden, Ph.D., Chair, The University of Texas at Austin Institutional Review Board for the Protection of Human Subjects, 512/471-8871.**

How will your privacy and the confidentiality of your research records be protected? Authorized persons from The University of Texas at Austin and the Institutional Review Board have the legal right to review your research records and will protect the confidentiality of those records to the extent permitted by law. If the research project is sponsored then the sponsor also has the legal right to review your research records. Otherwise, your research records will not be released without your consent unless required by law or a court order.

If the results of this research are published or presented at scientific meetings, your identity will not be disclosed.

The audio recordings made during the interview phase of this study will he (a) coded so that no personally identifying information is visible on them; (h) will he kept in a secure place (e.g., a locked file cabinet in the investigator's office); (c) will be heard or viewed only for research purposes by the investigator and his or her associates; and (d) will he erased after they are transcribed or coded.

Will the researchers benefit from your participation in this study? No

Signatures:

As a representative of this study, I have explained the purpose, the procedures, the benefits, and the risks that are involved in this research study:

Signature and printed name of person obtaining consent Date

You have been informed about this study's purpose, procedures, possible benefits and risks, and you have received a copy of this Form. You have been given the opportunity to ask questions before you sign, and you have been told that you can ask other questions at any time. You voluntarily agree to participate in this study. By signing this form, you are not waiving any of your legal rights.

Printed Name of Subject Date

Signature of Subject Date

Signature of Principal Investigator Date

Assent form for child between 13 and 17 years of age

"I have read the description of the study titled, Assessment of Social Competence in Children with Developmental Disorders, that is printed above, and I understand what the procedures are and what will happen to me in the study. I have received permission from my parent(s) to participate in the study, and I agree to participate in it. I know that I can quit the study at any time."

Signature of Minor Date

CONSENT FORM

Assessment of Social Competence in Children with Developmental Disorders

Your child/adolescent is invited to participate in a study of children and adolescent's ability to understand social interactions. My name is Margaret Semrud-Clikeman, Ph.D. and I am a professor at The University of Texas at Austin, Department of Educational Psychology. I am asking for permission to include your child/adolescent in this study because we are studying children's ability to understand social relationships. We are working with children who have difficulty with understanding as well as those who do not. I expect to have 500 participants in the study.

If you allow your child to participate, Margaret Semrud-Clikeman, Ph.D. will discuss the types of tasks your child and you will complete. These tasks include answering questions, completing block designs, drawing, and completing a computerized measure. In addition, your child and you will complete a behavioral rating scale. Completion of the tasks will take place at the Department of Educational Psychology at the University of Texas at Austin at your convenience **and at the convenience of the other children participating.** The assessment will be completed by doctoral students in school psychology under the supervision of Margaret Semrud-Clikeman, principal investigator.

Any information that is obtained in connection with this study and that can he identified with your child's name will remain confidential and will be disclosed only with your permission. His or her responses will not be linked to his or her name or your name in any written or verbal report of this research project. No information will be released without written permission from you.

Your decision to allow your child/adolescent to participate will not affect your or his or her present or future relationship with The University of Texas at Austin. If you have any questions about the study, please ask me. If you have any questions later, call me at (512) 471-0274. If you have any questions or concerns about your child/adolescent's participation in this study. call Professor Clarke Burnham, Chair of the University of Texas at Austin Institutional Review Board for the Protection of Human Research Participants at 232-4383.

You may keep the copy of this consent form.

You are making a decision about allowing your child/adolescent to participate in this study. Your signature below indicates that you have read the information provided above and have decided to allow him or her to participate in the study. If you later decide that you wish to withdraw your permission for your child/adolescent to participate in the study, simply tell me. You may discontinue his or her participation at any time.

_____
Printed Name of your Child

_____ _____
Signature of Parent(s) or Legal Guardian Date

Assent form for child between the ages of 6 and 12.

ASSENT FORM

Assessment of Social Competence in Children with Developmental Disorders

I agree to be in a study about how children understand emotions and friendships. This study was explained to my parents and they said that I could be in it. The only people who will know about what I say and do in the study will be the people in charge of the study and my parents.

In the study I will be asked questions about how I solve problems and answer questions. I will also work with block designs, draw, and work on a computer. I will also be asked how I feel about my myself and my friends. **If I am asked, I will be part of a group that meets to talk about how we know what we feel and gives me a chance to practice making friends.**

Writing my name on this page means that the page was read (by me/to me) and that I agree to be in the study. I know what will happen to me. If I decide to quit the study, all I have to do is tell the person in charge.

_____ _____
Child's Signature Date

Appendix C

Diagnostic Criteria for Attention-Deficit/Hyperactivity Disorder
(American Psychiatric Association, 2000)

A. Either (1) or (2):

(1) Six (or more) of the following symptoms of *inattention* have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level:

Inattention
(a) often fails to give close attention to details or makes careless mistakes in schoolwork, work, or other activities
(b) often has difficulty sustaining attention in tasks or play activities
(c) often does not seem to listen when spoken to directly
(d) often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (not due to oppositional behavior or failure to understand instructions)
(e) often has difficulty organizing tasks and activities
(f) often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork or homework)
(g) often loses things necessary for tasks or activities (e.g., toys, school assignments, pencils, books, or tools)
(h) is often easily distracted by extraneous stimuli
(i) is often forgetful in daily activities

(2) Six (or more) of the following symptoms of *hyperactivity-impulsivity* have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level:

Hyperactivity
(a) often fidgets with hands or feet or squirms in seat
(b) often leaves seat in classroom or in other situations in which remaining seated is expected
(c) often runs about or climbs excessively in situations in which it is inappropriate (in adolescents or adults, may be limited to subjective feelings of restlessness)
(d) often has difficulty playing or engaging in leisure activities quietly
(e) is often "on the go" or often acts as if "driven by a motor"
(f) often talks excessively

Impulsivity
(g) often blurts out answers before questions have been completed

(h) often has difficulty awaiting turn
(i) often interrupts or intrudes on others (e.g., butts into conversations or games)

B. Some hyperactive-impulsive or inattentive symptoms that caused impairment were present before age 7 years.

C. Some impairment from the symptoms is present in two or more settings (e.g., at school [work] and at home).

D. There must be clear evidence of clinically significant impairment in social, academic, or occupational functioning.

E. The symptoms do not occur exclusively during the course of a Pervasive Developmental Disorder, Schizophrenia, or other Psychotic Disorder and are not better accounted for by another mental disorder (e.g., Mood Disorder, Anxiety Disorder, Dissociative Disorder, or Personality Disorder).

Code based on type:

314.01 Attention-Deficit/Hyperactivity Disorder, Combined Type:
If both Criteria A1 and A2 are met for the past 6 months

314.00 Attention-Deficit/Hyperactivity Disorder, Predominately Inattentive Type: If Criterion A1 is met but Criterion A2 is not met for the past 6 months

314.01 Attention-Deficit/Hyperactivity Disorder, Predominately Hyperactive/Impulsive Type: If Criterion A2 is met but Criterion A1 is not met for the past 6 months

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Vita

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